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THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
ELECTRO-PLATERS REVIEW

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Standard Foundry Costs

A System Based on U. S. Government Income Tax Report Form 1040—Schedule B*

By THOMAS HARPER, Proprietor, Thomas Harper Brass Foundry, New York

The following description of how to classify and assemble manufacturing costs and of how to use them in the report made to the U. S. Government for income tax purposes was compiled to be read before the Metropolitan Brass Foundrs' Association of New York. The classifications shown are those applicable to making brass, bronze, and aluminum castings only and shows the fewest classifications found practicable. The same system is being used with appropriate classifications by electro-platers and polishers, manufacturers of auto sundries, brass finishers, electric motor repairers, machinists, pattern makers, manufacturers of vacuum cleaners, lumber dealers, hardware dealers and tile layers. All of the above different trades have found it efficient, and a most satisfactory method of getting a basis to conduct their business and by which to make prices. All of those who have adopted it have made good, and declare it meets their needs fully. As they have to have such data accumulated for the tax report it costs them practically nothing to get their costs and removes the worry attendant on making out reports or answering any governmental detailed inquiries as to how they arrive at their deductions. If you did not have to make out the tax reports it would still be necessary to do your bookkeeping thoroughly, and this method costs no more than the simplest methods and does give you a cost basis. Besides, no matter what it costs, every business has to be able to bear the cost of finding the cost of doing business; it is the most necessary expense. This method can be used as the tax report can, to cover completely the smallest or the largest business in the country. It is only a matter of classification.

GENERAL IGNORANCE OF COSTS

Of all the handicaps that retard business success, none is more serious than the ignorance of manfacturers in the matter of production costs. The Federal Trade Commission reports that in the United States only 10% of our industrial establishments know what it actually costs them to manufacture their products; 40% simply estimate their costs, and 50% have no method whatever of finding out what their production charges really are. This condition is largely responsible for a national situation where more than one-third of our 300,000 manufacturing concerns did not earn 1% on the billions of capital invested in them.

*A paper read at the meeting of the Metropolitan Brass Founders' Association, October 11, 1922.

The New York Board of Chartered Accountants claimed that there were less than 4% of the concerns in the State of New York that were doing a business of less than $100,000 per year that knew the costs of manufacturing their product.

Of the wills offered for probate in the city of New York less than 10% of the estates were solvent. This proves that there are only about 5% of the concerns in business that make a profit on their work or business and they must surely be the men that know the cost of production and make right prices.

That the problem of finding costs in any business is a very pressing one is shown by the large numbers of articles in magazines and trade papers and the pointed remarks in regard to business costs is general. That the man or company who does not keep costs and make his prices strictly in line with those costs is not doing business honestly or sanely is very evident. Open competition is demanded and is a necessity for advancement, but competition in price should be strictly the result of costs.

Cost of the product is due to efficiency of management. Costs vary as management does. They may be due to better equipment than competitors. They may be due to better location in relation to your market. They may be due to lower wages per unit produced paid by one employer than another in the same line of work. Whatever the reason, or for all of those reasons, the prices should be made according to those costs of your own establishment only, and it is your duty to know them, and know how to apply them to price making.

That our business suffers, just as much as any other, is shown when we hear that a large foundryman in the Pittsburgh district said that it would pay him to install free of charge a cost-keeping system into every one of the foundries that compete with him, and put in a man to keep it working, for if they (his competitors) knew their costs and made prices from these costs, it would pay him to do this, and moreover there would be fewer of his competitors going bankrupt.

During the war complaint was made that the malleable iron foundries were charging too high prices to the government. They were investigated. A corps of accountants was put on the case and it was found that 75% of the customers were not paying high enough prices while only 25% of the customers were paying prices that paid for the expense of making the castings and the services rendered. It was due to the

foundries' cost accounting or lack of it. The foundries were advised to increase their prices.

No prices should be made at a guess or because you want to meet the other fellows' prices, or the price that the buyer, a friend of yours, puts you wise to.

You should find costs in your brass foundry, and from those costs that you have ascertained make prices that will be equitable, prices that will allow you to buy your metal and pay for it, employ your help and pay them, invest your money, and be able to earn or pay interest on the amount invested, devote your time, care and energy to your business, and be assured that you will get a fair return for the endeavors you put forth. But you only do this if you sell for no lower than it costs you to produce plus a fair margin of profit.

CONFUSION IN COMPUTING COSTS

Nearly all the trouble seems to be caused by mixing up profits and overheads. The direct labor and material will be figured out all right, but the indirect labor and materials, the fixed charges, depreciation and interest on capital all seem to be forgotten. If you ask most business men about them they will tell you that they (the overheads) come out of the profits; but they do not. The last thing that is left is the profits, and there is very little of them when all the other costs are paid. That appears to be proved by the statement that 95% of all the concerns that are in business go through bankruptcy inside of twenty-five years.

If you invested in any manufacturing or commercial business you would expect a return of at least 8%, and if you did not have an expectation of getting more you would never put your money into it on account of the risk of loss. The Census figures show that capital is a constantly increasing factor in production. In 1899 the capital invested in manufacturing in the United States amounted to $1,770 for each person employed in the same industry. In 1904 it was $2,117 for each person employed. In 1909 it was $2,488 and in 1914 it was $2,848. What do you need? (See "Capital necessary.")

We consider that interest on the capital invested is a charge and has to be paid for. It should be charged directly to manufacturing and not to profit and loss account, as is usual, or deducted from the profits, if any, or considered as a profit, as many do. We do not consider it as a profit, any more than a workman considers his wages a profit. Interest should be included and charged on the pound of castings just as if it were wages.

FAIR PROFITS

What the United States Government allowed during the war is a fair amount, that is, 10% net profit. It ought not to be less. By 10% net I do not mean 10% over the net cost of labor and the cost of the metal used, including the loss on the metal, but 10% over all of the costs and overheads as well. That was what the Government allowed. That is the amount we have been using as a basis to make prices by.

In every branch of industry you will find men who know the cost to manufacture their products, and I have never found one of those men a price cutter. The 90% mentioned by the Federal Trade Commission as not knowing their costs cut so much that there is nothing left as a margin (by their methods) to be cut by the firms that know the cost of production.

It is often argued that the only solution to the problem of price cutting is a combination through a central bureau to control prices, but such a combination must stay within the law. The only combination that is allowed to operate according to law through a central bureau is the labor union, and its right to sell labor by collective bargaining is denied to those who would like to combine to sell the products of that labor.

A combination through a central bureau to control prices is not needed, but what is needed is a standard system of cost-finding. We pay the same price for metal, material, supplies, labor, machinery, etc. If proper cost accounting or a standard method of computing costs, such as the United States Government has established, is used, we ought to come close to the same cost of production.

When you have computed your price according to the costs of your establishment do not deviate from them or go lower than the basis you have figured as fair. You will have all kinds of bluffs made to get lower prices from you. All buyers consider that foundrymen are easy to buy from, and that they can always get a lower price than that first quoted; they know that foundrymen don't know their costs, but simply guess. In cases where the buyers are employed by a firm that is, or have been, operating a foundry, but want some castings made outside, they will tell you that their production costs are so-and-so per pound—far less than your quoted price. Find out if they can tell you how much capital was invested in their foundry department in tools, machinery and equipment; how much capital was used in carrying the foundry's share of the accounts; how much was charged for rent, bookkeeping, etc., and how much were they willing to accept as a fair profit on everything necessary to produce castings, labor included. You will find, as I have found, that they don't know and that they will say anything to get a lower price—even give the order to someone who has quoted higher than you to save their face.

You have never sold a pound of castings to anyone who did not want them, and no matter how much you cut there will be no more castings bought than they think they will need. Cutting prices does not create profits in the foundry, but only losses.

TAX REPORT AS A CONDENSED COST SHEET

The U. S. Government has rendered to the business men of this country one of the greatest services they have ever received in setting up a standard method of reporting income. On Form No. 1040, Schedule B is the most simple, complete and condensed basis of costs that has ever been published, and it is applicable to every business as a basis from which to figure costs. That it is to be used only as a basis and not as a full system is shown by the Government calling for a full explanation of your deductions years after you have filed your reports. For example, the writer has been called upon to furnish explanations of deduction No. 2 (Labor) and to show to whom paid, the amount paid to each, the period of employment and the nature of the service rendered. Also on deduction No. 3 he had to show the character of materials and supplies used, the amounts of the items and what class of labor used them. And at different times every deduction has had to be explained in detail. What they call for is only the necessary data that you need to use to make up a schedule of prices from your actual costs.

By using your last year's Government report you can escertain how much it cost you to do business and how much you made or lost, and by making divisions of the items in the report into classifications, as shown in the following illustrations, you will have the necessary data from which to compute your cost prices.

If you have shown a loss, increase those prices. If you have made too much profit, decrease them in the price table you compute. To enable you immediately to compare your costs for last year with your present prices, I have left the columns for money, weight, and hours blank, and show on the margin the item numbers in the Government report where you should find the proper data to assemble in your classifications of production costs.

In addition to the divisions shown, for your costs you will need the hours of labor for each classification, the pounds of aluminum castings sold, the pounds of brass or bronze castings sold during the period, the pounds of metal bought, the pounds of metal and price of the inventory at the beginning of the period and the pounds of metal and price at the end of the period.

If you assemble your current production cost according to the classifications illustrated and combine those charges into the items of the Government report, each item can be verified if you are called upon for an explanation. You simply have combined your production costs and entered them into your Government report as deductions.

The necessity of making the Income Tax Report has been the means of letting the individual business man of this country know where he stands in the conduct of his business more than anything that has ever happened. As the enforcement of this law becomes more stringent, and the demand for explanations becomes searching, the better it will be for business in general. I am of opinion that in ten years from now the enforcement of the Income Tax Law will so benefit conditions that you will find few concerns in the condition stated in the Federal report—not earning 1% on the money invested. They will know their costs and sell according to those costs or get out of business.

TO ASCERTAIN LOSS OF METAL INCURRED IN MAKING AND SELLING CASTINGS

Gov. Form No. 1040.	Pounds	Price
Item 6....Inventory at beginning of period.....	......	......
" 4....Plus metal purchased during period..	......	......
Total	......	......
" 8....Less inventory at end of period......	......	......
Shows the amount used during period	......	......
Deduct from the above, the amount sold in pounds....................	......	......
Balance left is the actual loss........	......	......

Divide the weight of castings sold into the amount lost which will give you the percentage of loss to add to the cost of metal or alloy to take care of that overhead on metal.

To get percentage of overheads to apply to Productive Labor Costs.

Add together the direct total for Molders, Melters, and Coremakers. Divide into the total of overheads. This will give you the percentage of Overhead to add to each class of Productive Labor.

SALES

NOTE—We have shown no charges for the cost of sales. The Item No. 10 of Gov. Report, Form 1040, Schedule B, so far is it applies to the cost of sales should be omitted from your productive labor overheads and should be added to the gross manufacturing costs and metal costs of the castings.

CAPITAL

The capital necessary to operate a business is as follows:

Inventory value of Machinery, Tools and Fixtures	$.........
Inventory value of Materials and Supplies	....
Inventory value of products in course of manufacture or for sale..........	....
Accounts Receivable	....
Balance in the bank and cash..........	....
	$.........

PRODUCTIVE LABOR OVERHEADS

Gov. Form No. 1040. Schedule B.	Pounds	Price
Item 2....Wages paid for bookkeepers.........	......	......
" 2....Wages paid for shipping and receiving	......	......
" 2....Wages paid for plant upkeep........	......	......
" 5....Employers' liability for above wages	......	......
" 3....All materials & supplies used by above	......	......
" 10....Salaries, bonuses and commissions not charged as labor..................	......	......
" 11....Rent on business property...........	......	......
" 12....Interest on business indebtedness to others	......	......
" 13....Taxes, city, state and federal........	......	......
" 14....Depreciation of machinery, tools and fixtures	......	......
" 16....Bad debts owing from sales if not fully covered by burden...........	......	......
" 17....Other expenses, fire insurance, telephone, credit information, lawyer's fees, collection charges, light, heat, power, etc., and all others expenses not already charged and necessary to the conduct of the business.....	......	......
Total	......	......

BURDEN

Interest on capital employed @8%— on gross business	3%
Profit	10%
Item 20...To provide for discounts, lost accounts and allowances	5%
Total	18%

PRODUCTIVE LABOR

Molding Costs

Item 2....Molder's wages......................	......	......
" 2....Floor helpers' wages.................	......	......
" 2....Cleaning and grinding castings.......	......	......
" 5....Employers' liability for above........	......	......
" 3....Materials and supplies used directly by above	......	......
Molders' direct total	......	......
Molders' percentage of overhead—%.	......	......
Molders' direct and overhead total...	......	......
Molders' burden 20% of total of direct and overhead casts................	......	......
Molders' gross total.............	......	......

The molders' gross total divided by the pounds of castings sold gives average pound price for molding.

The molders' gross total divided by the hours gives the hour cost per molder.

Multiply aluminum weight by 3 and add to pounds of brass or bronze sold to get your gross number of pounds.

MELTING COSTS

Gov. Form No. 1040. Schedule B.		
Item 2....Melters' wages	......	......
" 5....Melters' employer's liability..........	......	......
" 3....Melters' materials and supplies—fuel, crucibles and furnaces.............		
Melters' direct total	......	......
Melters' percentage of overhead—%	......	......
Melters' direct and overhead combined total	......	......
Melters' burden 20% of direct and overhead total	......	......
Gross total........................	......	......

For hour price, divide the gross total by melters' hours. For pound price divide the gross total by pounds of castings *sold* which gives the average melting cost per pound.

COREMAKING COSTS

Item 2	Coremakers' wages	......	......
" 2	Coatmakers' employers' liability	......	......
" 3	Coremakers' materials and supplies	......	......
	Coremakers' direct total	......	......
	Coremakers' Percentage of overhead	......	......
	Coremakers' direct and overhead combined total	......	......
	Coremakers' burden 20% of direct and overhead total	......	......
	Coremakers' gross total	......	......

The coremakers' hour price is found by dividing the gross total by the hours worked.

ALLOY COSTS

Item 4	Combined price of metals constituting alloy	......	......
" 1 & 4	Loss on metals	......	......
	Alloy cost direct total	......	......
" 20	Burden 20% on direct total	......	......
	Gross cost of alloy	......	......

EXAMPLE

Copper, 88 lbs. @ 14c	$12.32
Tin, 10 lbs. @ 32c	3.20
Zinc, 2 lbs. @ 7c	.14
	$15.66
Loss on metals, 10%	1.56
Cost of alloy	$17.22
Burden, 20%	3.44
Gross cost of alloy	$20.66

Column 6 shows the price to sell at.
Column 7 shows the price of output per 8-hour day.
Column 8 shows the net profit on output per 8-hour day.
Column 9 shows the net profit on labor per 8-hour day.
Column 10 shows the net profit on metal per 8-hour day.
Coremaking labor is to be added to pound price extra.

EXAMPLE

	Price per lb.
Weight of casting, 50 lbs.	$.32½
Coremaking one hour, $2.00	.04
Casting price	$.36½
Weight of casting, 10 lbs.	$.49
Coremaking one hour, $2.00	.20
Casting price	$.69

The last table shows clearly the high cost of light castings; for heavy castings, the large amount of capital necessary for the metal account and the necessity of provision for loss on metal and the burdens necessary to compensate for interest, lost accounts, discounts, allowances and a profit on the metal.

OLD METHODS OF COMPUTING COSTS

If you take note of the profit and price columns you can see how little per pound it takes to convert the profit into loss and how unwise it is to use one of the common methods of making prices which are to guess costs; to find out the other concerns' prices and make a lower price; to compute the average pro-

EXAMPLE OF POUND PRICE LIST

Molding, $4.00 per hour; Melting, 8c. per pound; Coremaking, $2.00 per hour; 16 Molds per 8-hour day

Pounds in 8 hours	Pounds in mold	Molding pound cost	Melting cost	Metal price	Selling price	8-hour output value	Net profit 10%	Profit 8 hours labor	Profit on metal
1	2	3	4	5	6	7	8	9	10
16	1	$2.00	$ .08	$ .2066	$2.28	$36.58	$3.66	$3.33	$.33
20	1¼	1.60	.08	.2066	1.88	37.77	3.77	3.36	.41
24	1½	1.33	.08	.2066	1.63	38.88	3.88	3.39	.49
28	1¾	1.14	.08	.2066	1.43	40.04	4.00	3.42	.58
32	2	1.00	.08	.2066	1.29	41.16	4.12	3.46	.66
40	2½	.80	.08	.2066	1.09	43.60	4.36	3.53	.83
48	3	.66	.08	.2066	.95	45.60	4.56	3.56	1.00
56	3½	.57	.08	.2066	.86	48.16	4.81	3.64	1.17
64	4	.50	.08	.2066	.79	50.58	5.06	3.72	1.34
80	5	.40	.08	.2066	.69	55.20	5.52	3.87	1.65
96	6	.33	.08	.2066	.62	59.52	5.65	3.97	1.98
112	7	.29	.08	.2066	.57	63.84	6.38	4.07	2.31
128	8	.25	.08	.2066	.54	69.12	6.91	4.27	2.64
160	10	.20	.08	.2066	.49	78.40	7.84	4.50	3.34
192	12	.17	.08	.2066	.46	88.32	8.83	4.82	4.00
256	16	.12	.08	.2066	.41	104.96	10.49	5.20	5.29
320	20	.10	.08	.2066	.39	124.80	12.48	5.87	6.61
384	24	.08⅓	.08	.2066	.37	142.08	14.20	6.30	7.81
448	28	.07⅛	.08	.2066	.36	160.68	16.07	6.81	9.26
512	32	.06⅛	.08	.2066	.35	179.20	17.92	7.35	10.58
576	36	.05½	.08	.2066	.34	195.84	19.58	7.68	11.90
672	42	.04¾	.08	.2066	.33½	225.12	22.51	8.72	13.88
736	46	.04⅓	.08	.2066	.33	242.88	24.29	9.09	15.90
800	50	.04	.08	.2066	.32½	361.28	26.13	9.60	16.53

EXPLANATION OF PRICE TABLE

Column 1 shows the weight of output per 8-hour day.
Column 2 shows the weight in a mold (16 molds per day).
Column 3 shows the price per pound for molding at $4.00 per hour.
Column 4 shows the price per pound for melting at 8 cents per pound.
Column 5 shows the price per pound for alloy at $.2066 per pound.

duction on so many cents over the price of the metal and using that as the price for castings. That method gives too low a price per pound for light and too high a price for heavy work. This shows the danger of making flat or average prices to a customer. Where the average cost of the mold as the basis for price plus the price of the metal is used, that is a very uncertain system. The number of molds that can be made per day is as varied as the size of the molds and the shape of patterns. Another method is to say that we have

to get so many dollars per day out of each molder—plus the price of the metal. This method will get the pound price on the heavy castings too low, and on light castings too high.

The above methods are very easy to compute and were very good in the old days when a brass molder melted his own metal, made his molds, with his helper poured off his work, dumped his molds, sifted sand, and the helper cleaned the castings and made the cores. Then the boss handed out his castings and got his money. Today it is different. The foundry is as specialized as other businesses are. We have floor molders, tub molders, machine molders, melters, coremakers, floor helpers, cleaners, grinders, machine and shop upkeep men, metal room and pattern loft men, foremen, bookkeepers, etc. Our cost system has to take care of these varied and different activities in the production of castings, and show us how to make a price for castings that will pay the foundry owner for the service rendered.

The methods that we illustrate will not increase your costs; it will only show you if applied to your own shop what your costs really are. By making out a price table according to those costs of production, you will see what your prices should be. It may result in some firms having to increase their prices or part of their prices to save themselves from loss and to be able to continue in business. It will certainly show you, after a careful comparison of the prices in the pound price list the great difference in the cost per pound for castings controlled by the output per hour or per mold, and the addition of the cost for melting and for metal. The coremaking cost is to be added to the price list cost. It will also recall to you many cases where you have made losses by quoting prices that were insufficient to cover your costs, that with such a guide you would not have quoted. I am positive that if you go over the orders you have on hand or keep track for the next few days that it will uncover to you many losses, large or small, that could have been avoided by laying out the mold, and making a right price for the work.

For example, a large brass foundry owner paid a visit to me a few weeks ago and as a matter of general interest I showed him our methods of making prices. I met him the other day and he cited an example of a pattern amongst others to be made in composition and said that he would ordinarily have looked at them and quoted 45c per pound. He kept time on the job and he found on all of the patterns but one he would get a fair profit at 45c but nothing extra. On that one pattern for which a large number were made he found according to his own hour cost for the molding, helping, coremaking and melting that the cost to him was $1.08 per pound. When he told the customer he went up in the air. But facts can't be disputed. From my own experience and others I believe that cases similar to the above are of daily occurrence and cause a continuous loss in operating a brass foundry, a loss that swallows up all of the gain. The brass foundry is one of the oldest and most essential industries in the world today and why there are such meagre profits passes comprehension. It may be that to make castings from the many poor and difficult patterns submitted needs the constant care and undivided attention of the owner or superintendent and has him absorbed in the matter of production, so that he has no inclination or time to compile or arrange data for his guidance in making prices which are fair to himself. For his own welfare he needs that done either by himself or someone capable of doing that work, just as he is capable of doing his work in the foundry. He should recognize his limitations and necessities.

The way the most of men act in regard to cost systems or making out an income tax report once a year reminds me of the story of the backwoodsman who, after a session with a comb came in with the comb broken, a handful of hair, and tears streaming down his cheeks and said, "I don't know how those people stand it that combs their hair every day. I've nearly ripped my scalp off and I only comb mine once a year."

Instead of going around squawking about the other concerns cutting prices inside and outside of the city, if you just think back as to how much you have honestly been able to report to the Government as profits, I am sure you can only come to the conclusion that you are some price cutter yourself. The way to improve matters is to begin with yourself and to know your costs.

If you do not know your costs you have to admit that you have no tangible basis to criticise the prices of competitors and that you are only depending on good fortune alone for a favorable result in the conduct of your business.

Casting Aluminum Bronze for French Coinage*

The French Government has decided to replace the paper money notes at present in circulation with small, golden-like coins of aluminum bronze.

In 1909 the French Ministry of France set up a Commission to propose a likely metal to replace the old coins then in existence. This commission asked an engineer who specialized in the question of alloys, P. H. Gaston Durville, to prepare bronzes of aluminum which should approach as near as possible to the metal of Sainte-Claire Deville, who experimented half a century ago, calling it French metal.

M. Durville is now preparing homogeneous ingots possessing a greenish-gold color, which can be polished as well as the hardest steels. One of the chief difficulties to be faced was the inclusion of slags, air bubbles and other oxidized bodies when pouring the ingots. To overcome this, M. Durville invented and patented an apparatus in 1913. It is composed of an ingot mold and a pocket or ladle rigidly connected with each other by a communicating canal. (This method was described in complete detail in THE METAL INDUSTRY for December, 1919, P. 507-9 and March, 1920, P. 118-120.) These three elements are kept in a straight line, once they are brought together. The ladle and canal are lined with refractory material.

At the factory at Mouy-Bury, where the Alloy and Forgeable Bronze Company employs the Durville method, the alloy is melted in a crucible, its free surface oxidizes and becomes covered with a film of alumina, which protects the parts of the bath below it from further oxidation. Once the alloy is melted, the pouring must be effected without the slightest agitation.

From the crucible the alloy is poured into the ladle, which is then rapidly attached to the ingot mold. The whole apparatus is then tilted, and the molten mass flows gently from the ladle into the four compartments into which the ingot mold is divided. The surface of the liquid bronze is kept horizontal throughout the operation. The alloy occupies successive positions without the least jerk, until it arrives in the ingot mold, where it solidifies. Its passage from one to the other is accomplished gently and evenly, in spite of the rapidity of the flow. As soon as solidification has taken place the ingots are withdrawn.

*From Engineer, London.

British Institute of Metals

Abstracts of Papers Read at the Autumn Meeting in Swansea, September 20-22, 1922

NEW SERIES OF LECTURES

A notable feature of the Swansea Meeting of the Institute of Metals was the inauguration of a series of annual public lectures on "Subjects of Practical Interest to Those Engaged in the Non-Ferrous Metals Industry." The lectures are additional to the well-known annual May Lectures of the Institute of Metals, which have constituted a notable feature of the Institute's work since 1910.

Dr. R. S. Hutton, a Member of Council of the Institute, and Director of the British Non-Ferrous Metals Research Association, delivered the first of the new lectures, this being entitled "The Science of Human effort—Motion Study and Vocational Training." The lecture was given at 8 P. M. on Tuesday, September 19th, at the Y. M. C. A., Swansea.

SIXTH REPORT TO THE CORROSION RESEARCH COMMITTEE OF THE INSTITUTE OF METALS on THE NATURE OF CORROSIVE ACTION, and the FUNCTION OF COLLOIDS IN CORROSION, by GUY D. BENGOUGH, M.A., D.Sc., and J. M. STUART, M.A.

This report attempts to present a general discussion of corrosion phenomena, based on the study of several different metals, and to examine how far the electro-chemical theory of corrosion (usually called the electrolytic theory) can account for the observed phenomena. The difficulties encountered by this theory are indicated, and it is shown that it gives a satisfactory account of the facts only under certain conditions, while many facts can only be explained by recognizing the important part played by *colloids* in corrosion. A theory of the mechanism of colloid action is put forward, and some experimental results are reviewed in the light of this theory.

The report commences by defining the terms corrosion, chemical exfoliation, erosion, and scale, which are used somewhat loosely by some writers. Corrosion is defined in its widest sense as the oxidation of a substance. It is then pointed out that such oxidation may be produced by chemical or electro-chemical means, and these two types of reaction are defined. Chemical reactions may occur when the reacting bodies are in contact, electro-chemical reactions when the reacting bodies are spatially separated. In the latter case the reacting substances must be capable of ionization, and a portion of the energy of the system appears as electrical energy. Two cases of corrosion are considered, both of which can be carried out chemically or electro-chemically. Pure electro-chemical action may in certain cases be relatively unimportant. Thus the cathode of a cell of high voltage may be more rapidly attacked than the anode, while an anode at a high voltage tending to force it into solution may be very little corroded, owing to scale formation.

Further facts which are difficult to explain on a purely electro-chemical theory are the following:

1. Certain depolarizers do not increase corrosion, but actually inhibit it.

2. The conductivity of electrolytes is not directly connected with the amount of corrosion.

3. Lambert's pure iron (probably the purest metal ever produced) was found to be readily attacked by sodium chloride solution and dilute acids.

4. According to the electro-chemical theory, the presence of ions of the corroding metal should depress the corrosion of most of the common metals. There are, however, numerous exceptions, and in some cases the presence of such ions actually increases corrosion.

The order of corrodibility of metals in distilled water, certain salt solutions, and non-electrolytes is different from their order in the electro-chemical list, which suggests that there are factors interfering with the electro-chemical action. Such a factor is scale formation, and a main factor in determining the amount of corrosion by water and salt solutions is the nature and distribution of the products of corrosion. This may be far more important than any hypothetical distribution of cathodes and anodes in the metal.

The effects of strain and impurity in the metal are considered on the electro-chemical view to be of fundamental importance, and Lambert's pure iron and lead were prepared with a view to eliminating both these factors. Neither metal was incorrodible in certain conditions. However, potential differences between strained and unstrained portions of the same metal are usually very small, and unstrained (annealed) metal may corrode more rapidly than strained metal. In fact, the effect of strain is a minor and ephemeral factor in corrosion in neutral solutions.

As regards the effect of impurities on the corrosion of metals a trace of impurity appears to assist local corrosion, but the amount of corrosion is not proportional to the amount of impurity. Even the presence of graphite does not appreciably stimulate the rate of corrosion of iron. The effect of a trace of impurity is probably a trigger action.

Local action at metallic surfaces may be produced in a variety of ways at any selected points by modifying the conditions external to the surfaces, and is not mainly determined by the presence of anodic areas on the metal. Minute pores in a metal may, however, give rise to local action, as has been shown by Seligman and Williams.

On the electro-chemical theory the action of oxygen is that of a depolarizer. It can be shown, however, that atmospheric oxygen has very little depolarizing power at ordinary temperatures. The main function of oxygen in corrosion is to oxidize directly the metal, and also on some cases the products of corrosion.

The effect of overvoltage on corrosion phenomena is briefly considered.

Two chief types of corrosion are distinguished: (1) The general type, usually characteristic of acid corrosion, (2) the local type, usually characteristic of corrosion in water and salt solutions. The second type is generally characterized by the formation of an adherent scale on the metal, and this scale may contain colloid.

A theory is developed regarding the part played by colloids in corrosion, and this theory may be briefly outlined as follows:

A metal immersed in water sends positively charged metal ions into the liquid, and becomes itself negatively charged. In the case of ordinary commercial metals, the metal also becomes superficially oxidized if dissolved oxygen is present. The hydroxide produced by this oxidation can take up the ions given off by the metal, and the hydroxide thereby passes into the state of a positicely charged colloid. Some of this colloid will diffuse away, permitting further reaction between the oxygen and the metal surface, and thereby reforming the hydroxide film over the latter. Oxidation is then stopped till this hydroxide can pass into the colloidal state by acquiring positively

charged metal ions. This, in general, does not take place till the colloid initially formed has diffused into the presence of electrolyte, when it is precipitated by the anion of the dissolved salt, the cation neutralizing the charge on the metal corresponding to that on the colloid. This allows the metal to send more ions into solution, and the uncharged hydroxide thereby acquires a charge. If the colloid so produced can diffuse away, the process can continue and corrosion develop.

For steady corrosion, therefore, the colloid must be produced under conditions which allow it to diffuse some distance from the metal before precipitation. If it precipitates directly on the corroding surface it will, in general, adhere to the latter and stop corrosion. In the case of a corrosion pit, the first condition is fulfilled, since no precipitation occurs inside the pit. It is only when the colloid diffuses through an aperture (generally very small), in the gel-deposits at the mouth of the pit, that it meets electrolyte and is then precipitated. Such precipitation merely thickens the external gel-deposits. These gel-deposits adhere directly to and protect the metal surrounding the pit, and thereby emphasize the local nature of the corrosion.

"WHITE METALS," by A. H. MUNDEY, C. C. BISSETT, B.A., B.Sc., B.Met, and J. CARTLAND, M.C., M.Sc.

The authors review the manufacture and use of white metal for industrial purposes.

The composition, mechanical and physical properties of the chief alloys are given. Their constitution and microstructure are dealt with only so far as the uses and manufacture are concerned.

The chief representative grades of antifriction or bearing metal are described, the application of appropriate alloys for particular purposes being indicated.

The effect of overheating or injudicious handling is described. Considerable attention is given to the preparation and properties of the various classes of printing alloys. The characteristics of each grade being given, the necessities of the printer and method of employment so far as these alloys are concerned, are discussed.

Brief references are made to die casting alloys, metals for chemical works, castings, solder, etc.

The paper is illustrated by photo-micrographs and prints.

"GRAIN-SIZE AND DIFFUSION," by Professor J. H. ANDREW, D.Sc., and ROBERT HIGGINS.

Experiments have been conducted which show the relation between grain growth and diffusion. Diffusion at high temperatures may take place simultaneously with grain-growth, whilst at low temperatures diffusion promotes a breakdown in the grain-size. These results have been applied to the annealing treatment of commercial castings. A suggestion has been advanced to explain the atomic arrangement existing at the grain boundary. It has been assumed that in the interior of the crystalline grains the system of closest packing holds, whilst at the boundaries the atoms in the separate grains touch only at one part of the circumference. This explains the decrease in specific gravity with an increase in the number of grains, for in such an arrangement certain free spaces must occur. Plastic deformation, by shifting the atoms in certain grains from their position of equilibrium, will cause these atoms to rearrange themselves when heated to a sufficiently high temperature; this arrangement will be so brought about that the stressed atoms will fall in with, row after row, the unstrained atoms of the adjacent crystal, thereby effecting a gradual migration of the grain boundary. Such a rearrangement may proceed from every side of a crystalline unit, resulting in one grain being divided up and being absorbed by others. The final bounding surface will result when a state consistent with that suggested for the boundary configuration finally results. A suggestion based upon the Langmuir idea of valency has been given to explain the migration of a separating phase to the grain boundary.

REPORT TO THE ALUMINIUM CORROSION RESEARCH SUB-COMMITTEE OF THE CORROSION RESEARCH COMMITTEE OF THE INSTITUTE OF METALS ON "EXPERIMENTS ON THE OXIDE METHOD OF DETERMINING ALUMINIUM," by J. E. CLENNELL, B.Sc.

The object of the investigation described in this Report was to find a direct method of determining aluminium in presence of iron and other impurities. The phosphate method was rejected as it had been found that the precipitates obtained showed varying proportions of alumina and phosphoric acid. The ammonia method of precipitating aluminium as hydroxide was likewise rejected owing to the difficulties of filtering and washing the precipitate and obtaining it free from impurities.

Experiments were made on the methods described by previous investigators, in which aluminium is precipitated as hydroxide by alkali nitrites, by phenyl-hydrazine and by a mixture of iodide and iodate of potassium, but more satisfactory results were obtained by precipitation with alkali thiosulphates.

It was found in nearly all cases that the weight of precipitate exceeded the theoretical amount calculated from the aluminium known to be present. This excess was traced to the presence of small quantities of absorbed substances, notably salts of iron and sulphates, probably of aluminium, which could not be removed by prolonged washing. Substitution of ammonium thiosulphate for the usually employed sodium salt did not reduce the excess.

A method was finally evolved whereby iron was practically eliminated and other impurities reduced to a minimum. This consists in passing sulphur dioxide through the slightly ammoniacal solution, precipitating in dilute, faintly acid, boiling solution with sodium thiosulphate with addition of dilute acetic acid, washing by decantation with hot 1 per cent ammonium chloride, filtering and washing with hot water. Iron, zinc, manganese and magnesium in ordinary amounts do not interfere, but when the first two are present in large quantity a double precipitation is necessary. The method was successfully applied in experimental work carried out for the Corrosion Research Committee on the oxidation of aluminium amalgam.

"THE CONSTITUTION AND AGE-HARDENING OF ALLOYS OF ALUMINIUM WITH COPPER MAGNESIUM, AND SILICON IN THE SOLID STATE," by MARIE L. V. GAYLER, M.Sc.

Constitution of the Alloys. The quaternary system of alloys containing aluminum, copper, magnesium and silicon has been regarded as the ternary system aluminium-copper-magnesium silicide, since magnesium and silicon were added in the proportions of the compound magnesium silicide, which is very stable at all temperatures.

The solubilities of copper and magnesium silicide in solid aluminium were determined at 500°C and 250°C and microscopic examination showed that the solubility of copper was reduced from 4.5 per cent to 2 per cent at 500°C by the presence of 0.7 per cent magnesium silicide; while 2 per cent of copper reduced the solubility of magnesium silicide from 1.2 per cent to 0.7 per cent at 500°C. At 250°C both constituents are turned out of solution when only 0.5 per cent of each are present.

Age-Hardening. Brinell hardness measurements were made on alloys in which the percentage content of one constituent was fixed which the other was varied, and which had been quenched from 500°C and allowed to age-harden at room temperature. The results showed that the age-hardening of these alloys is due to the difference in solubility at high and low temperatures of both copper and magnesium silicide. The maximum amount of age-hardening which it is possible to obtain from such alloys depends on the solubility in aluminium of both constituents in the presence of each other. Further heat treatment of these age-hardened alloys, at temperatures higher than room temperature, caused a preliminary softening before an increase in hardness; this is probably due to the process by which both compounds tend to come out of solution.

Derived differential curves of alloys which had been quenched, but which aged, show three critical points; the lowest point takes place at constant temperature, while the temperature of the two upper critical points is lowered with increased copper content; also the intensity of the uppermost point varies in a marked degree with the copper content. It is suggested that this point is due to the precipitation of the copper compound and the second point to the precipitation of magnesium silicide.

"THE COPPER-RICH ALUMINIUM-COPPER ALLOYS," by D. STOCKDALE, B.A.

The structures of the alloys of copper with aluminium up to 20 per cent of aluminium have been investigated by Stockdale, who used the thermal data supplied by a study of the cooling-curves of the alloys and by quenching experiments in conjunction with microscopic examination in order to obtain the equilibrium diagram more exactly. He discredits the opinion that the addition of small quantities of aluminium to pure copper raises the freezing point of that metal, and shows that the minimum in the liquidus curve at 1,031°C with 8.3 per cent of aluminium is a true eutectic point. A small arrest point at 1,017° with alloys containing between 16.5 and 18 per cent of aluminium in the liquidus at about 16 per cent.

Copper, at 1,000°C can hold only 7.4 per cent of aluminium in solid solution; at 500°C and at lower temperatures it can hold 9.8 per cent, although to obtain such an alloy a long annealing is required. The β solid solution breaks down above 535°C and Andrew's observations on the β and 5 constituents have been confirmed. That portion of the diagram concerning the β + field has been radically altered.

The paper is fully illustrated by microphotographs.

"THE EFFECTS OF OVERHEATING AND MELTING ON ALUMINIUM," by W. ROSENHAIN, D.Sc., F.R.S., and J. D. GROGAN, B.A.

The work described in this paper was undertaken to ascertain whether certain forms of treatment in the melting and re-melting of aluminium would bring about in the metal deterioration approximating to the condition generally described as "burnt" aluminium. It has been stated that exposure to an unduly high temperature during melting, and also repeated re-melting of the same material even at ordinary melting temperatures, brings about such deterioration.

Both kinds of treatment were tried.

High grade aluminium was poured at temperatures up to 1,000°C and also at the usual pouring temperature after heating at some hours at 1000°C. The castings so obtained were rolled to sheet form and tested in the annealed state. No deterioration in the metal could be detected.

High grade aluminium and also aluminium containing ¾ per cent of iron and silicon were cast to ¾-inch slabs and rolled to 0.01" sheet. This sheet was melted and cast and the whole process repeated ten times. Test pieces cut from sheet 0.05 inch thick from each melt gave figures which indicated no systematic change in the quality of the metal.

"THE STRUCTURE OF EUTECTICS," by F. L. BRADY, M.Sc.

The paper deals with structures exhibited by eutectics, mainly those between metals and metallic compounds. An attempt has been made to correlate the micro-properties of the component metals. The surface tension of the molten metal, and the cohesive force acting during crystallization seem to be the main forces influencing the final structure. The eutectics examined, which include those between metals whose physical forces are known, fall decidedly into three classes. The terms "globular," "lamellar" and "angular" have been suggested as convenient terms for these divisions. The structures agree well with what would be expected from theoretical considerations of the effects of surface tension and cohesion.

Reference is made to structures in eutectic igneous rocks, and an examination has been made of earlier work on the effect of rate of cooling on the size of the individual phase particles in a eutectic.

Photomicrographs are given of characteristic structures of the various alloys examined, and an account is given of the methods of polishing the alloys, and a list of the etching reagents found most suitable. It is hoped that the paper may lead to further investigation of the eutectic structure as a means of comparing the properties of the component metals or compounds in other cases than those specifically dealt with.

"THE ANTIMONY-BISMUTH SYSTEM," by MAURICE COOK, M.Sc.

Several workers have investigated the equilibrium diagram of these two metals and though the opinion that the system is isomorphous is generally held, the diagram has never been completed. Early investigators gave only the liquidus curve and Hüttner and Tammann in 1905 gave, in addition to a new liquidus curve, part of the sodius which they found to be horizontal at 266° ± 4°C and extending from 0 to 70 per cent of antimony.

In the present work very thorough thermal and microscopic investigations have been made. The results obtained, in addition to those from quenching and annealing experiments, show that the two metals form an isomorphous series of alloys. The liquidus curve is perfectly smooth and the solidus is horizontal at 270°C up to 60 per cent of antimony after which it rises steeply to the freezing point of antimony. Chill cast and slowly cooled specimens reveal duplex structures, but with prolonged annealing—550 hours at 275°C—the alloys become homogeneous.

Twin crystals and peculiar banded effects were observed in some of the annealed specimens. It is supposed that the twin crystals have been formed during the solidification of the alloy by stresses due to expansion, and have grown to visible dimensions on annealing. The nature of the "bands" has not been definitely ascertained, though they are not considered to be slipbands.

"INTERMETALLIC ACTIONS. THE SYSTEM THALLIUM-ARSENIC," by Q. A. MANSURI, B.A., M.Sc.

Mr. Q. A. Mansuri, B.A., M.Sc., by means of thermal analysis and microscopic analysis has shown that thallium and arsenic do not act chemically with each other nor do they form solid solutions. They alloy in all proportions and the equilibrium diagram of the system is a perfect case of the immiscibility type.

First, arsenic dissolves in molten thallium and lowers its freezing point until a solution of 8.01 per cent arsenic freezes at the eutectic temperature of 215°C. Then the freezing points of the alloys gradually rise to 240°C. All alloys containing from 13 to about 40 per cent arsenic begin to freeze at 240°C and are made up of two layers—the upper layer rich in arsenic while the lower rich in thallium. After about 40 per cent arsenic, to nearly pure arsenic, the solution is uniform and the two layers disappear.

A method of taking the cooling curves of volatile substances has been explained. It has been shown that by heating such substances in evacuated and sealed glass tubes and applying the hot injunction of the couple in close contact with the outside of the glass tube the couple is almost as sensitive as when dipped in molten substances.

"NEW FORMS OF APPARATUS FOR DETERMINING THE LINEAR SHRINKAGE AND FOR BOTTOM-POURING OF CAST METALS AND ALLOYS, ACCOMPANIED BY DATA ON THE SHRINKAGE AND HARDNESS OF CAST COPPER-ZINC ALLOYS," by F. JOHNSON, D.Sc., and W. GRANTLEY JONES.

In this paper the authors describe two new forms of apparatus:—

(a) For determining the total linear shrinkage of cast metals and alloys;

(b) For producing cast bars by a bottom-pouring method, the molten metal flowing from a specially heated crucible into the mould and the rate of flow being controlled by a lever-operated stopper.

Both forms of apparatus have been used in investigating the shrinkage and hardness of chill-cast copper-zinc alloys.

As regards the shrinkage values of these alloys, they are found to be higher in general than those obtained for sand-cast bars by previous investigators. The curve illustrating the relationship of shrinkage to composition confirms most of the features formerly discovered by Turney and Murray, but no minimum at 60 per cent copper is found.

In making the alloys pure electrolytic metals were used, whilst re-melted castings were excluded from the investigation. Most of the alloys were poured at a temperature interval of approximately 115°C above their liquidi, and the mould was kept at a constant temperature by means of an outer jacket of water maintained at the boiling point.

The alloys were prepared in a separate coke-fired melting furnace and transferred thence to the bottom-pouring apparatus, which is illustrated and described in detail. The advantages afforded by the use of this apparatus are many, viz:—

i. Control of pouring temperature;
ii. Facility for registering temperature of metal;
iii. Absence of delay between attainment of required pouring-temperature and release of metal into the mould;
iv. Control of rate of pouring;
v. Exclusion of dross from stream of metal, thus obviating the necessity of skimming;
vi. Mitigation of "zinc-fume."

The hardness of the bars was determined, both as cast and after annealing. Uniformity was not exhibited by the bars as cast, but was secured by annealing. In the case of annealed bars, the hardness numbers both by the Brinell and Shore (scleroscope) methods were plotted against composition. The Brinell curve showed an increase of hardness over the range 100 to 88 per cent copper. From 88 to 72 per cent copper the hardness was constant, a slight fall setting in at about 72 per cent copper and persisting to 63 per cent, at which point a rapid increase set in with the appearance of the beta constituent. With the exception of a small dip in the curve between 53 and 50 per cent copper the increase is maintained to 45 per cent copper.

The changes of scleroscopic hardness with composition are of a similar character to those revealed by the Brinell test, but less pronounced, whilst over the range 60 to 53 per cent copper, no increase of hardness is shown, such as that shown by the Brinell test. This would indicate a very slight difference, scleroscopically, between the beta and alpha phases. The top faces of the bars as cast are slightly softer than the bottom faces, owing to slower rate of cooling, and although this difference is diminished by annealing, it is not entirely eliminated in every case.

The annealed bars (containing 100 to 57 per cent copper) were cold-rolled, the reduction in thickness being approximately 50 per cent. The hardening capacity of the alpha brasses under cold-work increases rapidly with increase of zinc up to a maximum in the neighborhood of 75 per cent copper. The rolled strips, after close annealing were again tested for hardness, the results confirming those obtained on the bars as cast and annealed, with the exception that the range of uniform hardness is slightly restricted and the succeeding fall (between 70 and 63 per cent copper) is more pronounced.

"THE HARDNESS OF THE BRASSES AND SOME EXPERIMENTS ON ITS MEASUREMENTS BY MEANS OF A STRAINLESS INDENTATION," by F. W. HARRIS, M.Sc.

The object of this research was to make a careful study of the hardness of the brasses; and the theoretical conceptions surrounding the question of hardness and its relation to constitution were first discussed. For performing the tests, it was decided that the Brinell machine would be the most suitable apparatus to use in this instance.

Before the main research was commenced preliminary investigations were carried out in order to become fully cognizant with, and to measure the effect of, the various factors influencing the hardness. These experiments suggested the possibility of obtaining a value for the fundamental hardness of a material before strain set in.

The theories generally advanced with regard to the connection between hardness and internal constitution anomalies, however, which can only be explained by adopting a modified idea of the existing constitutional diagram.

A slight maximum was shown in the middle of the alpha phase, and a small depression in the beta phase.

A curve was established showing the "absolute" hardness for the series, as compared with the Brinell hardness. This latter curve was found to agree in general form with the ordinary one, but was somewhat less sinuous.

The author's curves show a general agreement in type with those of other workers, and confirm the maximum in the alpha phase shown by Meneghini and Turner and Murray, although throughout the series they are considerably lower in hardness value than those of the latter.

Shrinkage of Aluminum

At the Pittsburgh Experiment Station of the Bureau of Mines an investigation is being conducted with the purpose of measuring the total contraction in volume on freezing, and the linear contraction in different molds, of various light aluminum alloys. This study is in connection with the investigation on cracks in castings. Measurements have been made of the linear contraction in graphite molds of a series of commercial aluminum alloys and also of the total contraction in volume on freezing.

New English Electric Furnace

A Simple Electric Crucible Furnace for Melting Aluminum[1]

By A. GLYNNE LOBLEY[2]

It is generally recognized that in certain high temperature processes, and in cases where rapidity of melting is a criterion, the electric furnace may advantageously be used. But it is not equally realized in England that electric heating may economically replace fuel furnaces for processes of the opposite type, such as slow melting at low temperatures and the maintaining of metals molten over long periods.

It is the purpose of this paper to describe a case in which electricity was applied to the melting and keeping molten of aluminium for die-casting small objects. Such an instance is one which at first sight would hardly be thought to afford an economical opportunity for electric heating, in view of the simplicity with which gas may be used for that purpose. Nevertheless, an economical superiority does exist, and is due, primarily, to the greater facility with which the electric furnace may be thermally insulated.

The problem before the writer was to design an electric crucible furnace which would be equally convenient in operation, inexpensive to erect, and even with the small output of 85 to 100 lb. (38.6 to 45.4 kg.) per crucible per day, no more expensive in running costs.

The arrangement adopted is shown in section in Fig. 1. It consists essentially of a nichrome ribbon resistor, wound in a helix and supported on thin firebrick shelves round the crucible but not touching it. The crucible is removable for renewals without disturbing the resistor, and the whole is heat insulated with kieselguhr and special bricks, held in a container of ordinary brickwork. The helical arrangement made it possible to have sufficient area of resistor for the heat to be radiated and convected from it with a comparatively small difference of temperature between it and the crucible. Part of the resistor is carried under the crucible.

When first started, a plumbago crucible was used, but after running for some weeks the graphite was burnt out of the outer layers, leaving a porous clay mass of poor heat conductivity, with a consequent falling off in the efficiency of the furnace. A plain fireclay crucible was then substituted for the plumbago one, and this gave much better results.

DETAILS OF FURNACE

Crucible: Morgan's (Battersea, London) shape A, size 60. Capacity, 60 kilos of brass, *i. e.*, 35 to 40 pounds of aluminium.

Resistor: Nichrome II ribbon 0.25 by 0.04 in. (6.3 x 1mm.), wound in a helix 0.875 in. (22 mm.); external diameter, from 2.5 (at bottom) to 1.8 (at top) turns per inch; length of ribbon, approximately 155 feet (47.2 m.); length of helix, 27 feet (8.2 m.); resistance when hot, 10 ohms.

Voltage on furnace terminals: full on, 200; approximately half on, 135; approximately third on, 112.

Current varies slightly with temperature of furnace, owing to difference in resistance of ribbon, but is approximately 20, 13.6, and 11.4 amperes for above voltages. Kilovolt-amperes corresponding to above, 4.0, 1.8 and 1.3.

Exposed surface of ribbon: 3.75 sq. ft. (0.35 sq. m.) while the outer surface of crucible was 3 sq. ft. (0.28 sq. m.). On full power, 7.4 watts per sq. in. of exposed resistor surface, the exposed resistor surface being taken as area of one side and two edges of ribbon.

External diameter of special firebrick cylinder: 15.5 in. (89 cm.); average thickness of kieselguhr insulation, 5 in (12.7 cm.). Insulation brick, in vertical planes, replace the kieselguhr at intervals to give the necessary mechanical support to the internal structure.

The resistor was sprung into position and showed no tendency to touch the crucible. It could, however, have easily been fastened in place if desired.

The crucible was luted round the top edge (as shown), the iron plate being afterwards placed in position. While metal was being ladled the top was covered with a canopy open on one side, to minimize the heat losses; and when not ladling, with an insulated flat cover.

In this work an aluminium alloy containing 8 per cent of copper was being used, and in an average week 465 lb. (211 kg.) were melted with an energy consumption of 362 Kw. H.; that is 4 Kw. for 37 hours, 1.8 Kw. for 87 hours, 1.3 Kw. for 44 hours. Kilowatt hours per pound of metal melted, 0.78.

The crucibles cost two-thirds of the plumbago ones used in the gas furnace, and the life was at least as long, the minimum being two months. The cost of power and crucibles (Sheffield prices in 1920) was 1.07 pence per pound,

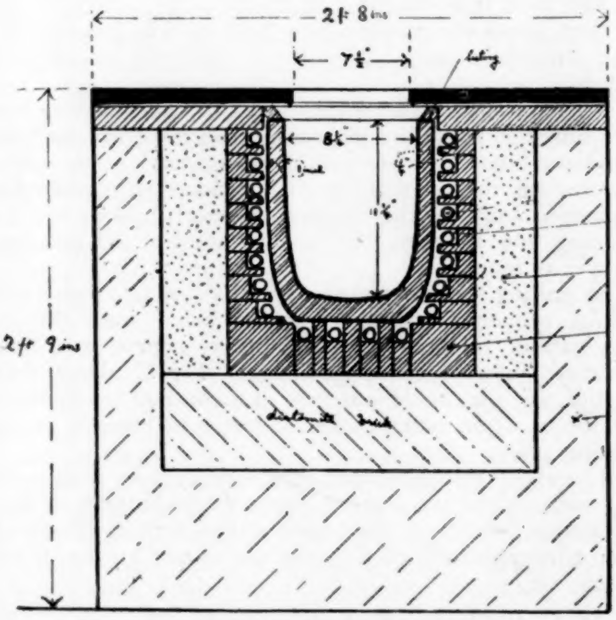

FIG. 1. SECTION OF FURNACE

while with the gas furnace the cost was 1.26 pence per pound.[3] The furnace gave no trouble and was much superior in every way to the gas furnace.

There was no opportunity of getting reliable figures of the metal losses, but they were quite evidently less, and the metal appeared much cleaner than with the gas furnace.

The writer admits that the simple experimental furnace described has only a low thermal efficiency, but that is inevitable where the ratio of output to capacity is so small, and where a crucible, open a large part of the time, is used; but he hopes to have shown that even under these conditions the electric furnace can successfully compete with the fuel furnace.

Unfortunately, in Great Britain the preference shown

[1]A paper presented at the forty-second general meeting of the American Electrochemical Society held in Montreal, September 21, 22 and 23, 1922.

[2]Director of Electrochemical Laboratories, the Victoria University of Manchester, England.

[3]At 1.3 pence per Kw. H., and 47 pence per 1,000 cu. ft. of gas.

by many foundrymen for crucible melting has played a large part in hindering the adoption of electric furnaces in non-ferrous work, and even at the present time they are little used.

In dealing with larger masses of aluminium the writer has designed and used granular carbon radiation furnaces; and as far back as 1918 had a large rectangular tilting furnace with a capacity of 1,500 pounds of aluminium, in successful operation. The design was on the same principle as the Baily furnace, but was independently, and apparently simultaneously, arrived at. It was the result of a series of experiments which showed that neither the induction nor the arc types was as suitable for aluminium as the radiation resistance.

As in the furnace described by D. D. Miller[4], there were two troughs containing the granular carbon, but the electrodes, trough supports, and mechanical arrangements were different. This furnace was probably the first non-ferrous electric melting furnace in Great Britain, but at this date a description of it would not be of interest, as a similar furnace, the Baily, is well known; moreover, it would be outside the scope of this paper.

The present crucible furnace was erected for The Sheffield Flatware Company, Ltd., and the writer desires to record his thanks to Dr. R. S. Hutton and The Sheffield Flatware Company for permitting this account of it.

[4]Chem. and Met. Eng., 1918, 19, 251.

Match Plates

A Comparison of Different Types of Match Plates and Gated Patterns

Written for The Metal Industry by JAMES T. MACKAY, Saint Louis Machine Tool Company, St. Louis, Mo.

Years ago, (and in a great many places, at the present time), gated patterns were considered the acme of perfection. It was not very long ago when a man who had a good lot of gated patterns was considered to be in the lead with satisfactory equipment for the best foundries. This, however, is past.

Gated patterns today are considered a back number by all progressive manufacturers and foundries. Any foundry that is accustomed to doing first class work will make a lower price, better delivery and better castings off a match plate pattern than they will off a gated pattern.

First, there has to be the follow board or a sandmatch or some other kind of a match made for every gated pattern. This is expensive to make, store and keep in order. It is expensive equipment to get out and pass to the molders when the work is re-ordered. The greatest difficulty, however, is that the patterns will work loose from the rapping and general handling, and when one pattern becomes loose it causes the whole gate to make a poor draw. The results are poor castings, delayed molders and heavy expenses.

With a little practice a patternmaker, toolmaker or ordinary machinist can make a match plate pattern more quickly then he can make the gated pattern, and when it is made, it almost never needs any repairing, as it is impossible to break these patterns off, or for them to become loose.

There are two different types of match plates, for snap flasks, either for hand molding or for machine molding. One is a match plate ready for mounting all classes of straight back work; the other is used for work that cannot be made with a flat back, or in other words that necessitates a curved shape in the parting. It is obvious that a pattern of this kind must be made up on what is termed "a cast up plate," but a good patternmaker can make the great majority of his work with a straight parting.

There are many large manufacturers of such items as cash registers, adding machines, typewriters, etc., who are discarding their cast-up plates because they cannot get the patterns finished to a nice enough degree of accuracy and are mounting them on flat plates.

The quickest way to work up these patterns is to face the two halves (ordinarily they do not need a great deal of facing) drill two holes in them at different points, about 1/8" more or less and put in a little piece of brass wire that will drive in tight. Then finish the two halves up pinned together with the brass wire. When they are finished take them apart, place one half on the match plate and drill from the holes in the pattern.

You do not necessarily have to be very careful that these are in perfect alignment and exactly the same distance apart. As much care can be taken as the operator sees fit, because the two halves have to be exactly opposite each other when again placed on the match plate and riveted on with brass wire cut off long enough to go through both halves of the pattern and match plate. It is well to countersink slightly the holes in the outside of the patterns with a three-cornered scraper to allow a slight riveting space. They should not be riveted very hard because there may be an occasion for taking the pattern off at some future time. The design may be changed or by some accident the pattern may get marred.

With this type of match plate it is very easy to take the patterns off, make any changes or repairs necessary on them and replace them. With a cast-up match plate this is impossible; the whole plate has to be scrapped.

Soft Gray Nickel

Q. I would like to know how I can obtain a soft gray nickel on hollow ware. The solution at present is made up of the following proportions:

6 oz. Double Nickel Salts per gal.
3 oz. Single Nickel Salts per gal.
2 oz. Boracic Acid per gal.
1 oz. Epsom Salts per gal.

and stands 7 degrees Baumé.

The work to be nickel plated is urns measuring from seven to eighteen inches in length and from three to nine inches in width, being larger at the top than at the base. The result is that the base is bright and at the top, around the opening, the plate is a dark gray and very hard to buff.

The urns are plated 1½ hours. Being hard to buff, the buffer has to bear on quite hard and cuts through the nickel on very nearly every piece of work.

A.—We are of the opinion that if you add not less than 1 oz. of white sal ammoniac per gallon to your nickel solution, and from 1/6 to 1/8 ounces of muriatic acid per gallon you will obtain the results you desire. Your present results are presumably due to a low conductivity, and a low acidity of the solution. The additions suggested should remedy these conditions.

Solutions which are composed of materials given in your formula require continuous additions of a free acid, such as muriatic acid, to keep up a normal deposit.

Cyanide solutions cannot be maintained in a normal condition without additions of cyanide added as free cyanide. Neither can nickel solutions be maintained in a normal condition without the addition of free acid in small amounts.—C. H. Proctor.

Foundry Book Compilers and Authors

How Not to Write Foundry Fiction

Written for The Metal Industry by WILLIAM H. PARRY, Foundryman

In looking over a raft of books each of which was supposed to be the last word on foundry lore, the fact was made evident that though the titles included such misnomers as "The Brass Founders' Guide" and "The Iron Founders' Companion," they are anything but what the titles imply. The frequent use of such phrases as, "it is said," "we think," "it is surmised," "we suppose," and "we hope," that one finds in these books casts very serious doubts as to their guidance and companionship for those seeking the truth on up-to-date foundry processes.

There is a vast difference between a book compiled by a fluent writer who knows next to nothing of the subjects treated, and one written by a practical mechanic, who, while he may not be able to compose properly, yet knows his business thoroughly. It may be claimed that the writings of practical men can be "touched up" by others so that they read well, but experience teaches otherwise, as the touching up process very often destroys the sense the author is trying to convey.

We have been told that there are men capable of writing books on any old subject in twenty-four hours, and judging by some of the books now on the market, it is not hard to believe that it can be, and is, very frequently done. The writing of a technical book on any subject, is a very serious task, if the result aimed at is to be of any value to its readers.

The compilation of a book, on the other hand means a lot of time looking up alleged authorities most of whom did that very same thing, so that the last compiler simply re-hashes a lot of misinformation and calls it a book, on the covers of which is emblazoned his name in gold letters put there to tell the world in general, and the duped readers in particular, what a genius he is, NOT. While there are a few splendid books devoted to foundry subjects now on the market, it is doubtful if the perfect book has been, or ever will be written, because of the wide divergence of opinion as to what constitutes the ideal work in the minds of those interested. Some there are who insist that such a book must be profusely illustrated with cuts showing how certain castings were made, while others contend, that if illustrations are used, they must make clear the principles that govern all foundry processes. Possibly a happy medium between these contentions would satisfy the majority of readers, but would it provide the perfect foundry book?

In my opinion it is not so much that illustrations must or must not be used, as it is what the pictures intend to convey to the reader's mind, as it must be admitted that most of the cuts in foundry books, show but little ability on the part of the makers thereof; particularly the perspective views, which are so poorly executed as to make one doubt whether there are rules that govern this style of illustration. Many of the cuts are too small, and it seems to be the rule, that the bigger the job the smaller the cut, whereas the opposite ought to prevail where possible. Any illustration to be effective should cover a full page at least, no matter how simple its lines may be, and the descriptive matter bearing on that cut ought to be on the opposite page or include not more than a few pages away, to prevent that nuisance of flipping pages back and forth in the attempt to connect the script with the cut.

Makers of foundry books have a decided weakness for including between their covers a lot of tables and receipts of doubtful lineage and value. In the old days when books were scarce and expensive, there was some excuse for the inclusion of table and receipt data, assuming that such information was reliable, but nowadays there is no room for such stuff as can be found in other works given up to that sort of thing.

Making foundry books of pocket size which would infer that the purchasers when in doubt as to how to proceed with some foundry problem would reach into their hip pocket for the concentrated essence of all knowledge, (if nothing stronger) is a mistaken idea, as foundrymen are not prone to carry books with them to consult within the unclean confines of a foundry, and would be laughed at if they did.

Books published in the last century and some in this present span of a hundred years, gave up a lot of space to loam molding. It must be admitted that such matter was very interesting, particularly to those who had never worked in foundries where this kind of molding was practiced. But loam molding while still numbered among the greatest of foundry accomplishments is not practiced to the extent that it was only a few years ago. While it always will be included as a means of producing large castings in limited quantities the space given up to it in a book is best utilized by describing the principles, using simple cuts and script that will not befog the minds of the readers, but give them a fair idea of how such castings are made.

It is questionable indeed, whether book knowledge is of any value as applied to loam molding, as the experience necessary to make castings by this method is obtained by actual contact with the work, and in no other manner. While some of the books do touch on skeleton work, by which is meant molding from skeleton patterns, it is not handled in a way that would inspire confidence in the minds of either molder or patternmaker. Yet it offers the means of making a great variety of castings cheaply and accurately, once the principle upon which it is founded is understood. Dry sand and green sand molding are too well understood to waste space in a book by showing how certain special castings are made in a little or big foundry by Tom Jones or Bill McCluskey.

Better by far give up all the space mapped out to foundry practices that mean something, and are based on such a solid foundation that the knowledge can be applied to a wide variety of work. This will not be the case, if the space is wasted to describe how a certain engine housing or chowder pot was made.

The making of production patterns can be included, and are to a limited extent in a few foundry works, but the subject is handled so gingerly, that the impression prevails that the authors or compilers used a long handled tongs when tackling this most important branch of foundry practice. As a matter of fact a pretty sizable book could be written on this subject alone, and still leave a

lot to be said, as the problems are infinite in variety, and always interesting.

The mounting of patterns on molding machines receives but scant attention in all foundry books; in fact is not even mentioned in most of them. It may be that it does not properly come within the scope of such writings, but, as all foundrymen who aspire to be in command of a foundry some day ought to be able to instruct those under them, it would seem that this important part of the game ought to be featured in every foundry book. The proper gating for castings of all classes is an art in itself, and any knowledge that can be acquired from books, while not as valuable as that gained through practical experience, is none the less an ever present help in times of trouble, especially, when all other methods have failed, and some description or cut in the book at least leads the mind into another train of thought that will apply to the problem that has defied all other means of solution. All of the old time books and some of the present era are very strong on the methods employed in the casting of bells, the sentimental value of which may appeal to some readers, but sentiment has no place in a technical book. If it had, I would advise the inclusion of the old college song, which runs something like this:

"I wish I had a barrel of rum,
With sugar three hundred pound,
The village bell to hold it in
With its clapper to stir it around."

This would seem to indicate one of the good uses bells can be put to outside of their usual functions, which include nerve racking noises with the full intention of destroying the peace of mind and sleep of all within their zone of usefulness.

The modern reader of foundry lore does not care a hoot how a bell is molded and cast. Insofar as its being a novelty or a foundry feat, it has been relegated to the rear, lo! these many years, and is regarded as being in a class with sash weights and sewer covers.

My advice to prospective writers, yea, even compilers, of foundry books is, to deal with up-to-date data only, cut out all verbiage, thus telling your story in as few words as possible and make the reading of your work "Short and sweet like a Coney Island peanut."

Gold Finishes

Gold on Brass, Tin and Lead Base

Written for The Metal Industry by CHARLES H. PROCTOR, Plating-Chemical Editor

Imitation Gold

Q. I would like to know how to get the imitation gold finish on brass as shown by the enclosed sample.

A. These articles are usually made of a brass termed "low brass." This metal is of a slightly more golden yellow than ordinary high brass. The low brass is especially adapted for articles of this type, which are satin finished with an ormolu dip, and then lacquered with a gold lacquer that is only slightly tinted with the gold color used in such lacquers.

The better grade of such puff and vanity boxes are gold plated after the ormolu and bright dips have been applied. The gold is plated by the aid of salt water gold solutions, as outlined in Platers' Wrinkles under "Gold Plating—Salt Water Gold Solutions."

To produce a good imitation of the ormolu gold finish, the same as that upon the sample you submitted, the method will be as follows:

1st. The articles should be cleansed as usual with the aid of hot cleaning solutions.

2nd. An ormolu dip should be made as follows:

Nitric acid 38°—as much as required.
Oxide of zinc—all that the nitric acid will absorb.

After the above mixture is prepared, try a few of the articles. Stir the dip and keep it quite warm. After some of the articles have been in the dip a moment or two, remove them, wash thoroughly and then bright dip them by the aid of the following dip:

Sulphuric Acid, 66°	1 gallon
Nitric 38°	1 "
Water	1 quart
Muriatic Acid	1 ounce

Prepare the dip some time before using. Keep it cool. It is advisable to place all dips in running water so that the temperature can be controlled.

After you have made a test of the two dips, ormolu and bright, wash and dry out carefully, and then note the surface of the article.

If the finish is too coarse and rough instead of a fine satin or velvety appearance, then it will be necessary to add sulphuric acid to the ormolu dip in small proportions until the satin or ormolu finish is of the desired tone. In replenishing ormolu dips nitric acid and zinc are the factors. Sulphuric acid is the controlling factor as outlined.

After you have produced a satisfactory dipped finish, lacquer with a lightly tinted gold lacquer. The spraying method gives the best results. A revolving turn-table should be used for lacquering, as all surfaces can be lacquered uniformly.

These are the methods used in the East. If you follow them you will obtain excellent results. The basic metal is, however, a big factor in getting the nearest imitation of a true gold finish. Any light acid stains should be removed by cyanide dips before lacquering.

Gold on Tin and Lead Foil

Q. How can I plate gold on tin or lead foil?

A. The gold plating of tin and lead foil will be somewhat of a difficult operation, especially if both sides of the foil must be plated and the pieces are of some length.

The difficulty will be in handling the foils. Frames should be made so that the foil may be clamped at each end to hold it in position. The width will determine how many pieces should be placed upon the frame.

The cleansing should be done by the aid of mild cleaners —mixtures of soda ash and tri-sodium phosphate and small amounts of sodium cyanide, based upon the following:

Water	1 gallon
Soda Ash	4 ounces
Tri-sodium Phosphate	2 "
Sodium Cyanide	¼ oz.

After cleansing the foil should be struck either in a brass solution or a regular silver strike solution, such as is mentioned in Platers' Wrinkle. Either one or the other of the gold solution formulas given in Wrinkles will answer for the gold-plating operation. An air-blast will possibly be required to dry the foil after plating.

The Cause of Red Stains on Silver-Plated Work

Effects of Using Rouge and Too High Speed in Polishing

Recorder* A. JEFFERSON, Member (Sheffield)

The red stains sometimes observed on finished articles which have been electro-plated with silver cause considerable annoyance, and their origin has been somewhat of a mystery to those engaged in the trade. The occurrence of the trouble in individual works is often intermittent, and by some has been considered seasonal and to be particularly prevalent in hot weather. The Sheffield Silver Trades Technical Society, consisting, as its name indicates, of members engaged in various capacities in the silver trades, beng desirous of contributing some practical advance in the solution of one of its industrial problems, appointed this committee to discuss the matter and subject it to experimental study.

A general discussion of the nature of the problem took place at the first meeting of the Committee.

Three quite distinct suggestions of the cause of the trouble were put forward: (1) That the red color on the finished article was due to oxide of copper from the basis metal, attracted through the silver coating by the heat evolved during the finishing and polishing processes; (2) some chemical or physical abnormality in the electro-deposited coating of silver; (3) the quality of the rouge or some effect dependent on slight variations in the manner in which it was employed.

There was evidence in favor of all these suggested causes, but none of them seems to have been submitted to exact experimental examination and logical reasoning.

The defect known as "fire" which occurs on the surface of finished sterling silver was also mentioned, but it was decided that the cause of that defect—oxidation of the copper—was sufficiently well known and was a quite distinct phenomenon. It was observed that the red stain in plated work was of two or more degrees, and might even be due to two or more different causes. The most important defect was the ruddy appearance, sometimes evenly and sometimes unevenly distributed, which was more noticeable on large plain surfaces than on surfaces decorated in any way, although it was possible that the discoloration was there in both cases, but less clearly evident on a decorated surface.

The theory that the origin of the red stain lay in the copper of the basis metal seemed to be supported by remarks dealing with the red stains found on the surface of brass goods, which remarks were made during a discussion that took place before the Birmingham Local Section of the Institute of Metals on November 8, 1921[1].

It was therefore decided to submit the problem to the test of experiment. With a view to making the test independent of the peculiarity of any one maker's metal, sheet was selected from stock ingots from the different works. This sheet metal was submitted to similar treatment in different factories and the results compared.

Nickel-silver discs, varying from 6 in. to 10 in. diameter, were given to four members of the Committee—three to each. All the discs were distinctly marked, and were subjected to hammering, buffing, and dollying.

At the second meeting of the Committee the reports of the members on their several observations were received, and one such report is typical of all.

After hammering, buffing, and dollying:

Specimen 1 showed brown stains practically all over surface.

Specimen 2, though pin-holey, was clear of stains.

Specimen 3 entirely clear, and a good surface.

Those showing stains were scratched round the stained places in such a manner that the same places could be studied after the plating and finishing operations.

It was then decided that all the discs should be plated under the same conditions, in one vat at one time; and Mr. A. Bowker very kindly undertook to arrange for the plating of the discs, a condition being that no special care was to be taken with them, but that they were to receive ordinary treatment. It was realized that this plating operation was important so that the subsequent condition of the various surfaces could be thoroughly examined and compared in the knowledge that all had been plated alike. After plating, it was decided that finishing by various methods should be adopted, again under commercial conditions, without special care either to cause or prevent any unusual result. Some were burnished only, some were burnished and hand-polished with rouge, some "compo." finished, some lime buff and lime dolly finished, and treated some with and some without rouge, thus covering widely varying processes of finishing.

The meeting at which these results were presented was very interesting. To begin with, it was observed that the red or brown stains which were in evidence on the unplated discs in several instances, could not now be seen, and in other instances, where no stain appeared on the nickel-silver disc, distinct evidence of the red was plainly visible.

Taking now the first set of results obtained after buffing and dollying, and putting the results of the finished tests alongside, the following comparative table is available:

TABLE I.

Appearance After Hammering, Buffing, and Dollying.	Silver Plated and then Finished as Follows:	Result.
(1) Brown stains practically all over surface.	(a) Burnished only. No rouge used.	No red showing anywhere.
	(b) "Compo." and rouge finished.	No red. Good clear surface.
(2) Pin-holey, but clear surface. No stains.	Burnished and hand-polished.	Showing slightly red.
(3) Very good clear surface.	(a) Lime and rouge finished. Rouge placed on mop, not on heated article. Light pressure.	Good black finish.
	(b) Same finishing materials used.. Rouge placed on heated surface. Good pressure applied.	Red streak where rouge was placed, other parts remaining clear.

This set was typical—where red was showing on the finished surface, rouge had been applied, though not **all which had been rouge finished** showed red.

The Committee were in these circumstances justified in

*This work was undertaken by a Committee of the Sheffield Silver Trades Technical Society, consisting of A. Bowker, Byron Carr, G. Carr, J. Higginbottom, T. H. Jarvis, A. Jefferson, W. Loukes, J. Shaw, J. Winterbottom, read at the Swansea Meeting of the British Institute of Metal, September 20-22, 1922

[1]Metal Industry, London, 1921, vol. xix (No. 22), pp. 423-425.

concluding that the stains on the basis metal did not come to the surface; and this conclusion is supported by the fact that copper oxide appears only on the surface of metals when heated in the presence of air (from the basis metal), and an ordinary coating of silver effectively excludes air from the basis metal, and there is no copper in electrolytically deposited silver.

The Committee were also compelled to reject the theory that the process of plating was responsible for red work, because all the discs were plated under identical conditions, in the same vat, at the same time, and, as already stated, some discs were red and others not red after finishing.

These two rejected theories led them up to the point of considering the rouge finishing and hand-polishing processes as being responsible for the trouble.

In order to test this, one of the discs which had absolutely no red at all (No. 3 in Table I.) was given to a practical hollow-ware finisher, who asserted that he could put a streak of red down the centre of the disc or anywhere else they selected. He proved his assertion, and put a good distinct red band about 3 in. or 4 in. broad down the center, and gave it as his unqualified opinion that most of the red work in plated articles was due to:

(1) Too high a speed of running; and (2) to applying rouge on an overheated surface, thereby presenting a more or less porous surface with a favorable condition for absorbing the rouge into the open pores of the heated silver surface.

This was a most interesting proposition, and the practical evidence that red could be made to soak into the hot porous surface gave the Committee much food for thought.

This disc with the red mark in was given to Mr. Byron Carr, who made a careful examination of it.

He reported that he had succeeded in dissolving some of the red out by means of sulphuric acid, and on testing the solution found distinct evidence of iron oxide. This proved conclusively that the application of rouge was, in this case, responsible for the red. The rouge used on this test-piece was precisely the same as that which was used in the first instance and gave the "No Red" result as Specimen 3A, which establishes the fact that red work can be and often is produced by indiscriminate application of rouge at this stage and overheating the surface metal in either finishing or handing, because not all the rouged discs were red, and some were red in patches. It was said that if a polisher would not put fresh rouge on to a place which had just been handed, but go to a cool part of the article and then return to the now cooled original surface, red could not arise, and the same applies to wheel finishing.

The vexed question of the qualities of rouge, mercurial or non-mercurial, arose, but the Committee regret that they had not sufficient material at their disposal to go further into this matter, which is therefore left for future investigation.

The thanks of the Committee are given to Mr. H. Hutton, Mr. S. Gladwin, and Messrs. The Heeley Silver Rolling and Wire Mills Limited for discs on which to operate.

Nickel Plating

Written for The Metal Industry by CHARLES H. PROCTOR, Plating-Chemical Editor

Rust Proof Nickel on Steel

Q. I want a rust-proof nickel deposit on steel retaining rims for automobile wheels. What is the procedure?

A. To produce a rust-proof nickel upon steel, an electro deposit of either zinc or cadmium will have to be applied to the surface of the steel first.

Zinc gives an excellent base when deposited from improved zinc cyanide solutions; but cadmium must be given the preference for the reason that nickel can be deposited upon cadmium as easily as upon steel, copper or brass if the acidity of the nickel solution is controlled.

A good deposit of cadmium is of a dull silver white color. It is always advisable to color buff cadmium deposits before nickel-plating so as to obtain a good uniform surface.

The following formula will give good results in cadmium-plating:

Water	1	gallon
Sodium Cyanide	5	ounces
Cadmium Hydrate	2½	ounces
Caustic Soda	½	ounce

Temperature 80 deg. Fahr. at 2½ volts. Anodes should be steel and cadmium.

A ten-minute deposit upon steel followed by color-buffing should give a rust-proof surface. A nickel deposit of fairly good thickness should be applied to the cadmium plated surface.

In polishing steel retaining rings for automobiles, made from cold rolled steel, we would advise as follows:

First: Pickle off the scale with a hot pickle consisting of equal proportions of water and muriatic acid, wash in cold and boiling waters, and dry out.

Second: Rough out upon felt or canvas wheels, using 150 emery if the surface is not too rough and deeply etched.

Third: Repolish by the aid of tampico bristle wheels, using emery paste and tripoli applied to the wheel.

If a higher finish is wanted, it may be necessary to use a cutting down buff wheel and to finish with White Diamond or similar white lime compositions.

Q. Kindly send me formula for a white nickel solution for barrel plating. I would like to have you state the voltage and how high the solution should stand. My work is on steel hose supporters. I have trouble with my solutions not plating very white.

Barrel Nickel

A. We would suggest that you try the following formula for barrel nickel-plating. It should give you the desired results.

Water	1	gallon
Double Nickel Salts	8	ounces
Single Nickel Salts	2	"
Boracic Acid	3	"
Sal Ammoniac	1½	"
Pure Muriatic Acid	¼	"

Voltage 8 to 9. This solution should stand about 10 deg. Baumé. Build up the solution with single salts, boracic acid, sal ammoniac and muriatic acid in proportions as follows, to be increased as may be required:

Water	
Single Nickel Salts	1 pound
Boracic Acid	2 ounces
Sal Ammoniac	2 "
Muriatic Acid	½ ounce

Electro-Plating — Its Past, Present and Future

An Indictment of the Typical Foreman Plater and His Attitude Towards the Scientist

Written for The Metal Industry by JOSEPH HAAS, Jr., Plater

The history of the development of electro-plating, or one of the practical applications of electro-chemistry, goes back to the year 1789, when Galvani made his discovery of contact electricity. From that time on, various magnetic, electrical and chemical discoveries by such men as Volta, Nicholson, Carlisle, Cruikshank (who investigated the behavior of solutions of silver nitrate, copper sulphate and acetate of lead toward galvanic current), Bruignatelli (who obtained the first results in electro-gilding), Davy, Gersted, Franklin, Ohm, and Faraday made possible the realization of the reduction of metals and metallic alloys from solutions of their salts by means of an electric current. In other words, the works of these men made possible the development of electro-plating. The practical works and discoveries of Prof. Jacobi; Spencer, De Ruolz, Murray, Smee, Prof. Boettger, Scheele, Prince and son, Wilde, Pacinotti, Siemens, Wheatstone, Watts, Dr. Langbein and Arrhenius brought about rapid progress in electro-plating, and through the skill of these men, practical methods of electro deposition found speedy application in the arts. It is both impossible and outside of the scope of this article to detail the accomplishments of these men, but the object in view in mentioning them as the pioneers of electro-plating is to ask where are the practical electro-platers, the "rule of thumb" workers, the secret guardians that have made electro-plating possible? One looks for them in vain. All the above mentioned men were scientific investigators. And yet, the plater of today, scorns the works of the scientist, claiming that "it may be all right in theory, but it does not work in practice."

A statement of this kind loses sight of what is both theory and practice. Theory, as interpreted by the practical man is anything that is scientific. But the purpose of any science is to explain the phenomena of nature, and electro-plating or applied electro-chemistry is one of the phenomena of nature. In explaining phenomena of nature, an endeavor is made to prove the truth in terms of undisputed and universally admitted facts. But often this cannot be done. Although certain phenomena bring definite results, we can find out nothing in regard to their cause or why the cause should be what it is. The most notable example is electricity. What is it? We do not know. However, we do know that the passage of an electric current gives magnetic properties to a wire, generates heat in the wire, and that the wire immersed in certain solutions will cause the solutions to be decomposed.

Again, why can an electric current be passed through certain solutions and not through others? We do not know, but we try to know and in that way we arrive at an explanation that is called a theory, because it is not based upon undisputed facts and because it is a reasonable and just assumption to make in view of the results we obtain in making this assumption. Such is the status of the theory of electrolytic dissociation. One is justified in keeping this assumption until it is proved false by the assistance of undisputed fact or truths.

Referring back to the theory of electrolytic dissociation, although we do not know why certain substances dissociate and others do not, or why dissociation should take place at all, or why it takes place in the case of certain substances and not at all in the case of others, we are justified in adhering to this theory because it explains much in applied electro chemistry. So it can be readily seen that the word theory is most frequently misapplied. When taken at its final interpretation, what is the difference between practice and theory? Does the dynamo work upon practical or scientific principles? Is there any difference between the two terms as generally understood? Is one the opposite of the other? No other conclusion can be reached but that one is the commercial application of the other. Are lathes, power presses, steam engines, drill presses, hydraulic presses and motors built and operated upon scientific or practical principles? Are the results obtained from them dependent upon scientific or practical principles? What has the modern electro-plater done, more than apply commercially the works of the scientific investigators? Then surely it ought to be profitable for the electro-plater to understand the science of what he practices, because he will be able to work more intelligently, with more certainty and accuracy.

Electro-plating has been, up to the last ten years, a trade with guarded secrets, and entirely without reason since there were no secrets to guard. With the advent of the American Electro-Platers' Society much of this secretiveness has disappeared. The interest that Prof. Watts, Dr. Mathers, Dr. Blum, Chas. H. Proctor and George B. Hogaboom have taken in the advancement of electro-plating, is doing much to bring electro-plating up to the respect that it deserves. But their work will be in vain, unless the fundamental causes that made THE METAL INDUSTRY, in June, 1921, run the following editorial, are eliminated. "The metal coating industry which includes electro-plating, polishing, finishing, zincing and tinning needs more than anything else, technical information. The men in charge of the work are very seldom properly trained, having been taught by the rule of thumb method, and generally lack the background to acquire a real understanding of the science of their industry." Who and what is the cause of this astonishing editorial? It is the electro-plater foreman, the plater's helper and the manufacturer, each as much at fault as the other.

The statement is frequently made that it is unnecessary that the electro-plater be a student of electricity and chemistry. No statement can be made that is further from the truth. The simplest thing in electro-plating is making a solution that will give a deposit. But to maintain the solution operating so that uniform and constant results are obtained is a different matter. To maintain solutions operating continuously so that there is no loss in production from any of them is also a different matter. To remedy and rectify difficulties the instant they arise is not as simple as making up a plating solution.

The indifference of the electro-plater as to the why and how of electro-plating is appalling. He goes on from day to day expecting trouble; he gets it; he may correct it, but why he gets it and how it can be anticipated, and thus prevented, is a matter to which he is indifferent. To him it seems that it must be so.

This indifference has placed the plater in a bad light in the eyes of his employer and his superintendent. He has had to wriggle out of his difficulties by means of poor and ridiculous excuses, often placing difficulties and hardships upon other people. This has placed the plater in a plane of general tolerance, which, like all crawling things, is necessary in this world. It is common to hear electro-platers express that they are not receiving the salaries they should be getting in proportion to their responsibilities and the call upon their knowledge. They are not, but yet employers think that of all the ignorant men demanding high salaries, the plater is the most ignorant. He demands a salary, not for what he knows, but for what he is supposed to know. If all platers knew what they are supposed to know, many saalries would be doubled.

A more striking example of platers' indifference to their own progress could not be given than the following extract from a letter written by a factory superintendent. "Our friend's method of the management of a plating solution seems to be on the order of a girl graduate with a cook book, and produces similar results. Unless an analytical laboratory were installed with two or three chemists, it would be impossible to keep track of the constituents of his baths. This is about his method. Light plate reported. Foreman states bath is weak in metal; adds half a barrel of X; tries to plate; adds a bucket of Y. The bath is probably so tormented by each addition that in desperation it commences to plate again for a short time. The same happens again in a day or two. As a result of such haphazard methods, I wonder we get results at all. I am firmly of the opinion that if I made my living by plating, I should certainly learn that end of the game. The best I can say is that the solutions stand a frightful lot of abuse."

Here is a plater, who to the writer's personal knowledge, prefers to hit or miss, rather than to do his work in a systematic manner, and under scientific control. This man could hardly have a better position or opportunity, as his firm is most generous in sending him to platers' banquets and conventions, so that he may learn. He, however, makes no progress. Were he able to analyze his solutions, thus keeping them operating properly, he would save his firm considerable money, gain a reputation from the precision with which his work is done and command a higher salary.

What excuses can be found for such conditions which seem to be the rule rather than the exception? None, legitimately, but it might be said that most of the platers have gotten along well without technical knowledge, and they think they can continue to do so. Their success might be questioned. If success is considered merely holding down a job with more or less trouble, it is no success. To hold a position successfully is to hold it in such a way that you can have your employer's and superintendent's undivided respect and confidence, and that they receive your reasons and opinions as coming from a man who knows what he is talking about. Platers, generally, are not regarded in such a light.

When one wishes to be considerate, one can readily pardon the old platers. But what can be said for the young men in the business? What excuses can be found for the plater's helper, with evening schools in existence where electricity and chemistry are taught? As a matter of experiment, the writer last summer started a class in the electro-chemistry of plating. While many inquiries were received, the class itself was small in comparison and all that started did not finish. The men would not study the lessons assigned, even after they had been first explained. They preferred to talk about their plating experiences, about their foremen who naturally know less about plating than they themselves. If one were to believe all that the helpers have to say about their foremen, and of their own ability, positions ought to be exchanged. It never seems to occur to the helpers, that unless they follow different steps, or methods of learning the details of electro-plating, they will not be different from the plating-room foremen of today whom they condemn so severely. A logical conclusion is that if you know why you must do certain things and how it works, you can do your work better, much more easily and economically.

That the manufacturer is to blame equally with the foreman plater and helper, will hardly be denied by anyone. He is at fault in two ways. In the first place, he has not given consideration to the kind of man he has had at the head of his plating department, so long as he claimed he was a plater. The manufacturer, had he kept abreast of the times in the efficiency of the plating department as he has with his other departments, would have demanded that his plater have more than a stock of "trade secrets." He would have demanded a man of more general education, a man with a knowledge of chemistry and electricity, a man that could assist him in arriving at plating costs.

On the other hand it sometimes occurs that a manufacturer has in his employment, a plater who fully realizes, and is acquainted in the technical requirements of plating and yet such a man is not held in much more esteem than those who have not the knowledge. Nor is he fully allowed or encouraged to use all his knowledge for the benefit of the firm. He is denied voltmeters, ammeters and a test laboratory, so that he may keep his solutions under control. Those platers that have formerly worked by rule of thumb and then studied chemistry, have frequently testified that they would not care to go back to the former method. The excuse one hears most frequently from platers as to why they neglect the technical side of their business is that manufacturers do not require it, and do not appreciate the plater more for having such knowledge. This is but partly true, as at present the general tendency among large manufacturers is to secure men with technical knowledge of electro-plating.

What will be the future of electro-plating? In referring to the editorial in The Metal Industry of June, 1921, we read, "Eventually this business may get into the hands of the chemists who are even now coming into it." Plating is a science based upon applying commercially pure chemical and electrical sciences. Research in electro-plating is now carried on only by a few. There are many problems and seeming contradictions in electro-plating, and a wider research is desirable. New facts brought out, are not applied in the trade as rapidly as they should, because most of the men in the business are not of the proper mentality to apply them; old methods are too rigidly adhered to. It is extremely desirable that a wider understanding and a greater application of chemical laws be made in electro-plating. This will be accomplished by the advent of the chemist in electro-plating.

Federal Taxes

In 1915 corporations paid 1% of their net income in Federal Tax. In 1917, 22% in Federal taxes. In 1919 the manufacturing industry of the country paid 68% of the Federal Taxes.—Mining Congress.

National Exposition of the Chemical Industries

A Report of the Exhibits Relating to Metals

The eighth National Exposition of the Chemical Industries which was held at the Grand Central Palace, New York City during the week of September 11th, proved to be the most interesting exposition which has ever been held, from the standpoint of the metal manufacturer and user. An extraordinary number of concerns manufacturing and using metals, exhibited, and it is not too much to say that this branch was perhaps the most important single industry in evidence. Not only did the manufacturers of metals take space but manufacturers of accessories and equipment were prominent.

The plating and polishing industries were also well represented. Lacquer was featured by three concerns in exhibits that compared favorably in beauty and variety in applications with any other at the exposition.

Exhibits related to metals were as follows:

A. J. Becker, Caldwell, N. Y.—Safety carboy carriers.

Allis-Chalmers Manufacturing Company, New York—Pumps; turbines; machinery, etc.

American Cyanamid Company, New York City—Cyanamid.

American Manganese Bronze Company, Holmesburg, Pa.—Manganese bronze; Hy-Ten-Sl bronze; phosphor bronze (high lead); centrifugal castings of brass, bronze and aluminum.

Anaconda Copper Mining Company—American Brass Company, New York—Ore, blister, matte, shot, ingot, cake and wire bar copper; zinc ore and slabs, brass, bronze, nickel silver, sheet, tube, wire and rod; by products of copper manufactured such as copper sulphate, selenium, tellurium, silver and gold; also white lead and basic lead carbonate.

Armstrong Cork & Insulation Company, Pittsburgh, Pa.—Insulating materials.

Aterite Company, New York—Valves and fittings and Aterite, also springs, chains and sheet metal; castings of Fanosite (a light metal).

Atlantic Tank & Barrel Corp., Louisville, Ky.—Wooden tanks and barrels, plating tanks.

Baker & Company, Inc., Newark, N. J.—Platinum, platinum ware, wire, chemicals, couples, foil, screen and platinum plating.

Bakelite Corporation, New York City—Bakelite products, such as Bakelite, Condensite and Redmanol.

Baltimore Copper Smelting & Rolling Company, Baltimore, Md.—Copper products and by-products; copper roping and shingles.

British-American Nickel Company, New York—Sheet nickel in various forms—electrolytic and malleable.

Calorizing Company, Pittsburgh, Pa.—Calorizing and Calite—a cast alloy to stand 2,200° F.

C. E. Sholes Company, New York—Fabricated products of Monel nickel and copper.

Celite Products Company, New York City—Sil-O-Cel and insulation materials.

Commercial Solvents Corporation, New York—Solvents; Acetone; Butanol.

Crane Company, Chicago, Ill.—Valves, fittings, etc.

Dings Magnetic Separator Company, Milwaukee, Wis.—Magnetic separators of material from iron.

Egyptian Lacquer Manufacturing Company, New York—Lacquers for all conceivable types of objects.

General Electric Company, Schenectady, N. Y.—Portable semi-automatic arc welder; soft metal melting pot; glue pot; soldering iron furnace.

Hardinge Company, New York City—Conical grinding mill.

Haynes Stellite Company, New York—Stellite in various forms—High speed tools; cutters, etc., medical and dental instruments.

Illinois Zinc Company, Peru, Ill.—Zinc products (shingles, pipe, ducts, etc.).

International Nickel Company, New York—Nickel products; Monel products, such as textile machinery and driers, anodes, sheet wire, screen rod, bar, castings, fabricated products, valve and turbine parts.

J. L. Mott Iron Works, New York City—Chemical kettles; melting pots; plumbing, etc.

Lead Lined Pipe Company, Wakefield, Mass.—Lead-lined pipe, fittings and valves.

Lunkenheimer Company, Cincinnati, Ohio—Valves of all sorts.

Manning, Maxwell & Moore, New York—Valves of brass and modified Monel metal.

Maas & Waldstein, New York—Lacquers; lacquer enamels; wood lacquers and leather solutions for a wide variety of purposes.

New Jersey Zinc Company, New York—Zinc slab, castings, zinc oxide, stampings, spinnings, slush castings, plated and unplated and other products.

Norton Company, Worcester, Mass.—Refractories of all sorts for grinding, polishing, etc.

Palo Company, New York—Meker melting and heat treating furnaces.

Schaeffer & Budenberg Manufacturing Company, Brooklyn, N. Y.—Scientific instruments and gauges.

Roessler & Hasslacher Chemical Company, New York—Plating chemicals; cyanides; antimony sulphide, etc.

Quigley Furnace Specialties Company, New York City—Refractories; Insuline (the base material); Insulbrix, a refractory brick; Hytempite, a refractory cement.

S. Obermayer Company, Chicago, Ill.—High temperature cement; Hott Patch; clays; graphite; iron filler; charcoal and other foundry supplies.

Surface Combustion Company, New York—Industrial furnaces; testing furnaces.

Thwing Instrument Company, Philadelphia, Pa.—Pyrometers (plain and recording).

Tolhurst Machine Works, Troy, N. Y.—Centrifugals; driers.

Tuc-Tur Metal Company, New York—Tuc Tur Metal, an acid resisting alloy of copper, nickel, zinc.

United Lead Company, New York City—Lead products; tin and lead lined valves; fittings and chemical appliances.

Wayne Tank & Pump Company, Ft. Wayne, Indiana—Melting furnaces and oil tanks, gauges, etc.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.—Electrical equipment of all sorts soft metal melting furnaces; equipment for electric brass furnaces.

Wheeler Condenser & Engineering Company, Carteret, N. J.—Condensers; condenser tubing, etc.

York Metal and Alloys Company, New York—Tungsten; molybdenum and vanadium products.

Young Bros. Company, Detroit, Mich.—Core ovens.

Zeller Lacquer Manufacturing Company, New York—Lacquers for a wide variety of products, such as stoves, pipeless heaters, hot air registers, lighting fixtures, novelties, etc.

THE METAL INDUSTRY

With Which Are Incorporated

THE ALUMINUM WORLD, COPPER and BRASS, THE BRASS FOUNDER and FINISHER, THE ELECTRO-PLATERS' REVIEW

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Contents

EDITORIAL

FOUNDRY COST KEEPING

In this issue will be found a most interesting article on Standard Foundry Costs by Thomas Harper. The thing that distinguishes this article from others on this subject is the fact that Mr. Harper is a practical foundryman, a foundry proprietor, who has as his object, not the creation of a delicate, intricate system which will require the supervision of experts to keep in order but a practical, simple tool which will tell the foundryman what he wants to know without the least amount of effort.

Over and over again foundry literature has hammered on the point that in order to be successful the foundryman must know his costs. It is not sufficient for him to know roughly that melting costs about so much and molding about so much, but he must be able to quote accurately, and sometimes rapidly, on castings of various sizes and shapes. The average foundry is not large enough to support an extensive cost system. The high mortality of the foundry industry is due almost entirely to this fundamental failing—lack of knowledge in making quotations. This point Mr. Harper goes into in detail and it will be worth while for every foundryman to read what he has to say.

With his system there may be many who will disagree, but the point is that he has a system which, as he states, operates successfully with him. In other words, his foundry pays, which is, after all, one test of a system. When one considers how careful foundrymen have been in the past about telling what they knew, and how they arrived at their prices, all the more credit is due to Mr. Harper for coming out in the open with what he has to say. If foundrymen, whether they agree with him or not, will take his warnings to heart and even though they can not use the system that is laid out, will at least devise good ones of their own so that they will not charge less than they can afford to make castings, there will be fewer failures, and much more general health in the foundry industry.

TARIFF

A glance over the tariff as finally passed leaves the average unbiased citizen more or less in the dark as to its results. By a simple comparison with the former (Underwood) tariff it is evident that the increase has been exceedingly large. Chemicals seem to have benefited all along the line; metals have been sharply raised; refractories have also gone up. The one metal which was left, as before, on the free list, in spite of considerable pressure brought to bear to place a tariff on it, is tin, and about this, as about all the other items on the schedule, conflicting opinions can be obtained. The metal market has already risen steadily, whether or not largely caused by the tariff, no one knows. Undoubtedly other conditions have had their effect.

Nevertheless, foundries and metal using factories must expect to pay more for their raw materials than in the past. In order to make a profit they will have to pass on this cost to their customers. The result will be a general rise is prices; possibly a perceptible increase in business due to the elimination of a number of imported items. How long this increased business will continue and whether it will over-balance the loss in exports, which is likely to follow, is a question at which even the best can only guess.

It is said by some that even if the tariff should react unfavorably on business, a change of administration in 1924 will give Congress the opportunity to revise it downward again, but there is no comfort for business in such procedure. We can only say what has been said over and over again, that business can never become really stable until the tariff has been taken out of politics and placed in the hands of experts.

THE COAL INDUSTRY

Now that the coal strike is over business can heave a sigh of relief and go back to work. If, however, that is all it does, it will be nothing more than an acceptance of a perhaps not undeserved recurrence of this misfortune in a comparatively short time. There have been strikes and strikes in the past, but none which showed so clearly to the public what must be done. In the past when a strike was settled everyone said "Thank Heaven it is over" and completely forgot about the possibility of another. The public is faced now with the almost absolute certainty of another strike within the next year if this industry is not straightened out.

Fortunately, legislation has provided for the creation of a National Coal Commission to investigate thoroughly the troubles of this industry in the past. Such a commission leads us to hope that perhaps there will be more accurate information and less billingsgate from both sides. It is obvious that in the bituminous industry, at least, it is no longer safe to leave the working out of its salvation to those who have been in charge in the past. Some of the operators claim that they could straighten out the industry if they could have a free hand in dealing with the miners, but in places where they have had a comparatively free hand, such as certain sections of West Virginia, the constant warfare has contradicted this statement.

Several interesting proposals were mentioned by Secretary Hoover in a speech before the Salesmen's Association of the American Chemical Industry, September 12th, in New York City. Among them were—an extra annual storage of 20 per cent of the railway consumption to equalize the seasonal fluctuation; a system of car distribution that would not in itself break into the regular operation of the mines; larger storage for public utilities; co-operative marketing by the mines as it has been developed by some farmers. As Mr. Hoover states, the point of dominant importance is that the whole employee and employer relationship requires reform before a stable industry can be secured. Steadier work will, of course, eliminate a large part of the friction, but this is probably not the whole story. These recurrent conflicts are simply the symptoms of a disease in the industry which must first be diagnosed thoroughly and then cured.

Hopes for uninterrupted industrial operation will depend to a considerable degree on the work of the National Coal Commission.

TWELVE-HOUR DAY

The question of the 8 versus 12-hour day has again come to the front through a report of the Committee on Work-Periods of the American Engineering Council of the Federated American Engineering Societies. This report finds that the two-shift day of 12 hours each is not an economic necessity in the American industry.

It is stated that in every continuous industry some plants are operating three eight-hour shifts, at the same time competing with others which operate two twelve-hour shifts. Moreover, in practically every major continuous

industry, plants which have changed from the twelve to the eight-hour shift have increased the quantity of production per man up to as much as twenty-five per cent, and even higher in a few cases.

That this report is authentic is shown by the character of the men in charge of the work.—Bradley Stoughton of New York, former secretary of the A. I. M. E., investigated the iron and steel industries, while Horace B. Drury, formerly of the faculty of Ohio State University, made a general survey of all industries operating continuously twenty-four hours a day. The personnel of the board to which these reports were made consists of some of the leading industrial engineers of the country.

Although the subject has been gone over many times before it is worth while to note the confident and positive statements which these reports make. Dr. Drury says, "The effect of the eight-hour as compared with the twelve-hour shift operation on the quantity and quality of production, absenteeism and industrial accidents has been satisfactory where good management and co-operation of labor have been secured. In practically every major continuous industry there are plants which have increased the quantity of production per man as much as 25 per cent. In a few exceptional cases the increase has been much higher. Evidence shows also an improvement in quality of production following the reduction in the length of shifts."

Mr. Stoughton found that "the eight-hour day makes better men physically and mentally, attracts a better class of men to the industry, improves conduct of operation, makes operation more uniform, betters the quality of product, uses less fuel, involves less waste and less repairs to equipment, and lengthens the life of apparatus. These advantages are bound up in increased efficiency manifested in increased production per man per hour and per machine per day. The eight-hour day produces better morale among workers, resulting in less absence and tardiness, less shirking and better discipline, better spirit among the men and more work because of the greater pressure which his foreman can and will exert because they do not have to hold back out of sympathy for tired men."

WHITE AND RED LEAD IN PLUMBING

The National Association of Brass Manufacturers in a resolution printed on page 403 of this issue condemned the use of white and red lead by plumbers when installing plumbing fixtures of all kinds. The Association has requested publicity in connection with this resolution as it was the consensus of opinion of its membership that the use of these materials is injurious to the public at large.

THE METAL INDUSTRY will be glad to receive expressions of opinion and reasons therefor. This question seems to be a serious one and should be properly discussed.

CORRESPONDENCE and DISCUSSION

Although we cordially invite criticisms and expressions of opinion in these columns, THE METAL INDUSTRY assumes no responsibility for statements made therein.

A VISITOR FROM AUSTRALIA

CHARLES H. PROCTOR, Plating-Chemical Editor, THE METAL INDUSTRY:

In THE METAL INDUSTRY of May, 1922, in the article "Re Newark Platers," I notice the statement that you are the founder of The American Electro-Platers' Society and chemical-editor of THE METAL INDUSTRY. Such being the case, I have taken the liberty of writing to you.

I am endeavoring to place my business in this country on the most modern footing.

In July, 1920, I visited the U. S. A., and called at THE METAL INDUSTRY office, and entered a subscription thereto, which I have renewed by mail preceding this letter.

As I had arranged to stay only a very limited time in the States (thereby committing a great error of judgment), with a view to spending a longer period in England, I was unable to do very much other than inquire into modern methods.

I am at present considering making another trip to your country, and should such eventuate would spend a few months there.

Could you, through your society, arrange for me to get experience in several of the large electro-plating works using mechanical methods of plating, so that if I were to purchase a complete mechanical plating outfit, as advertised by your platers' suppliers, I would have the knowledge of the correct methods of using the same, and would be thus able to instruct members of my staff in the use thereof?

The plating industry is in a rather primitive stage in this country, but the possibility of further manufacture and therefore a greater business is here.

I would be pleased to hear from you as soon as possible if the arrangements suggested can be carried out.

Should your time be limited, you may be able to put me in touch with some other official of your society who could arrange what I desire.

Feeling sure from the courtesies shown me on my previous trip by the Americans with whom I came in contact that you will do your best for me.

H. W. ASHER.

Sydney, N. S. W., Australia,
June 21, 1922.

M. W. ASHER, Sydney, N. S. W., Australia:

Your very interesting letter of June 21 reached my hands several days ago on my return from a Middle West trip.

Your letter is of particular interest to me because I appreciate the fact that you turn to America to obtain the information that will enable you to practice the precepts laid down here for the advancement in the electro-plating industry.

It will be my pleasure to request the publication of your letter in The American Electro-Platers' Society "Bulletin" and THE METAL INDUSTRY, requesting all members of the society who can possibly arrange visits to their respective plants for you, especially in plating plants where mechanical plating is the factor, and to advise me direct in writing.

If you will notify me some time in advance of your possible arrival in America, the responses from the members of The American Electro-Platers' Society will be tabulated so that plants that in my estimation will prove of the most interest to you can be visited during your sojourn here.

C. H. PROCTOR.

New York, N. Y.
Sepember 1, 1922.

NEW BOOKS

A. S. T. M. Standards Adopted in 1922. Published by the American Society for Testing Materials, 1315 Spruce street, Philadelphia, Pa. Price $1.25.

This pamphlet contains 12 standards adopted by letter ballot of the Society on August 25, 1922. It forms the first supplement to the 1921 Book of A. S. T. M. Standards. Non-ferrous specifications are B 30-22, Brass Ingot Metal, Graded and Ungraded, for Sand Castings and B 39-22, Nickel.

GOVERNMENT PUBLICATIONS

Mineral Resources of the United States in 1921, by G. F. Loughlin and Martha B. Clark, U. S. Geological Survey, Washington, D. C.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

ASSOCIATE EDITORS { JESSE L. JONES, Metallurgical / WILLIAM J. REARDON, Foundry } PETER W. BLAIR, Mechanical / LOUIS J. KROM, Rolling Mill / CHARLES H. PROCTOR, Plating-Chemical / R. E. SEARCH, Exchange-Research

ALUMINUM FOR WELDING

Q.—Is there an aluminum casting alloy that will weld easily? If so, can you give us the formula? We are considering using aluminum castings on some of our work and it requires some welding.

A.—No. 12 Alloy is very easy to weld. Almost all the aluminum crank cases for automobiles are made of this alloy, and considerable welding is often done on this work without difficulty. It is necessary, however, to heat the casting that is to be welded to a red heat in a furnace that will exclude the air, so as to relieve all strain and avoid cracking during the welding process.

No. 12 alloy consists of:

Aluminum	92%
Copper	8%

W. J. R. Problem 3,125.

CLEANING STEEL

Q.—I have had great difficulty in securing a suitable material for cleaning the steel which is used in manufacturing skates.

These steel bars are received covered with oil or grease, and this must be thoroughly cleaned before the steel can be utilized, particularly for nickel plating. They have tried various products and have also tried lye, but still without satisfactory results.

What would you suggest in a case of this kind? They would like to discover something which will enable them to clean this steel so thoroughly that they could eliminate the present method of scrubbing with powdered pumice stone.

A.—We presume the oil used upon the steel that your customer has so much trouble in removing is mineral oil.

There is practically no cleaner upon the market that will absolutely saponify the oil and leave a clean metal surface.

Gasoline or benzine or trichlorethane are the best solvents. It is possible to use the latter solvent and recover the oils dissolved, and use the material over again. It is absolutely non-explosive.

The only chemical method that would accomplish the purpose would be an electro-chemical cleaning method. For this purpose an iron tank should be used. Connections should be made directly from not less than a six-volt generator. In the circuit, however, should be arranged a double-throw switch, so that the articles to be electro-cleansed can first be made the cathode as in regular plating, the iron tank becoming the anode. The direct electro-cleaning should be done in two minutes at a high amperage at 6 volts.

At the end of two minutes the current should be reversed by the double-throw switch, so that the articles to be cleansed should now become the anode, and the iron tank the cathode.

From one-half to one minute on the reversed current should be ample.

The electro-cleaning solution should be composed as follows:

Water	1 gallon
Caustic Soda	4 ozs.
Soda Ash	4 "
Silicate of Soda	1 oz.
Sodium Cyanide	½ "

Temperature of solution 180 deg. Fahr.

Replenishing of the solution should be made upon a similar basis, but as carbonate is continually formed, then soda ash can be omitted.—C. H. P. Problem 3,126.

DISCOLORED ALUMINUM

Q.—We are sending to you by parcel post a sample aluminum step plate, which we have cast. Our customer rejected these plates because of the discoloration in them. We have cast these out of scrap aluminum, consisting of old crank casing, pots and other sheet metal products.

Will you please be so kind as to advise us what you think causes this discoloration and the remedy, and is there any way that the discoloration in those already casted can be removed. It is these step plates that we wrote to you about some time ago, asking as to the method of finishing. We have had to take the whole job so as to get the casting end of it.

A.—We are of the opinion that the cause of this discoloration is an excessive amount of copper in the mixture, and when pouring this light step-plate casting, the metal is poured somewhat hotter than for large castings and this causes copper streaks. The casting has the appearance of metal that has been properly handled in the melting, and the only cause of this discoloration is excess copper in the mixture. It appears to be about 10 or 11%. There is no dip that will remove this discoloration. The sand blast will give the best results.

We would suggest that you use 80% of the scrap you are using and 20 pounds of pure aluminum, and just before pouring add about one to two ounces of tin. This will whiten up the mixture and give you the required amount of copper and aluminum, which should be 92 aluminum and 8 copper.—W. J. R. Problem 3,127.

HIGH PRESSURE VALVES

Q.—We desire a formula for valves for high pressure superheat steam, to have a different color than bronze, preferably white. We tried a mixture: 50 lake copper, 25 refiners' Slab zinc, 25 pure shot nickel. This metal has the appearance and strength but is porous, and the fracture has the same look as aluminum in bronze. It was melted in forced draft coke fire.

A.—An alloy tried for high pressure steam fittings in the Russian navy years ago and said to give good results consists of 70 copper, 20 nickel, 10 zinc.

It is fluxed with a small piece of magnesium, and is said to be alloyed as follows: Half the copper and all the zinc was first melted and cast in ingots and then sheared in small pieces. The nickel is placed in the bottom of the crucible, then a layer of shearings, then a layer of copper, then melt and pour into ingots and remelt before casting. Five per cent. of the zinc is lost and is made up. The alloy shrinks considerably and large risers are necessary.

A good mixture we have in use for this work which gives satisfaction consists of 83 copper, 10 tin, 3 nickel, 2 zinc.

Another mixture we have tried consists of 40 Monel metal shot, 44 copper, 15 hardener and 1 manganese titanium. The hardener consists of 30 copper, 10 aluminum and 60 zinc.—W. J. R. Problem. 3,128.

HIGH TENSILE BRONZE

Q.—I have been making vanadium elevator gears weighing from 100 to 400 lbs. of the following mixture: 57 lbs. copper, 39 lbs. horse head spelter, 13 oz. nickel, 8 oz. pure aluminum, 15 oz. iron wire, 16 oz. tin, 8 oz. vanadium, as I receive it from the American Vanadium Company, which is 35 per cent. pure.

The test bar made from above mixture tested as follows: Tensile strength, 71,750 lbs., Elastic limit, 27,250 lbs. and elongation 35½ per cent.

I am requested to increase the elastic limit to about 40,000 lbs., reduce the elongation to something like 15 per cent., and use practically the above metals. Can you advise me which of the metals to increase, and which ones to reduce, to give above results?

A.—Your mixture is somewhat similar to manganese bronze, and a true elastic limit of 40,000 lbs. per square inch is in our estimation very hard to obtain. However, the yield point of 40,000 lbs. per square inch can be obtained, and for the mixture you are using we would suggest that you reduce the tin to 8 ounces and increase the iron contents to one and one-half pounds. Also suggest that you use Norway Iron or tin plate instead of iron wire. Also suggest that you make a hardener of:

13 oz.	nickel
1½ oz.	iron
½ oz.	tin
½ oz.	aluminum

Charge the nickel and the iron into the crucible, and when at a red heat add the tin, then the aluminum, and when melted stir well and pour into ingots. Next melt your copper. Get it good and hot, and add the hardener, then the zinc and then the vanadium.—W. J. R. Problem 3,129.

LUBRICANT FOR DRAWING LEAD

Q.—Kindly advise me what lubricant it is best to use in drawing small lead articles in presses. Articles in question are similar to bottle tops, etc., such as used on toilet waters. A lubricant that will draw such articles bright is necessary, so as to eliminate buffing before plating.

A.—For working brass or copper a solution composed of 15 pounds of Fullers' soap to a barrel of hot water, or any soap strong in rosin or potash, is cheaper and cleaner than oil. The stock should pass through a tank filled with this solution before entering the dies. As the metal you are using is of a greasy nature you do not require a lubricant with a heavy body.—P. W. B. Problem 3,130.

METAL IN SULPHATE OF ZINC

Q.—Kindly let me know of a mixture or metal that will stand the sulphate of zinc solution?

A.—For a metal that will stand sulphate of zinc solution for fittings inside of a tank, we would suggest a mixture of:

Copper	83%
Tin	10%
Nickel	5%
Zinc	2%

To make this alloy a hardener of 50% nickel and 50% tin is first made and poured into ingots. In making this alloy charge the nickel in the crucible first and bring it to a red heat, then charge the tin, and the nickel will melt readily.

Use as follows:

Melt	83 copper
Add	5 tin
Add	10 hardener
Add	2 zinc

Stir well and pour. This metal is non-corrosive but is hard to machine.

Another mixture we would recommend consists of:

Copper	55%
Nickel	12%
Zinc	32%
Aluminum	1%

This metal is a white metal and is non-corrosive and may be the mixture you desire, and is not so hard to machine.—W. J. R. Problem 3,131.

POLISHING WHEELS

Q.—We have a large number of steel bars 36 inches long ⅛" wide ¼" thick, common black finish. We desire to grind these by hand on an emery wheel so they will have a good finish for nickel plating. We want a good flat wheel, and thought to make it of wood, coated with emery. As we have never fitted up a wheel in this way we would be very glad if you can give detailed instructions through The Metal Industry also naming best grades of emery to use.

A.—There are many varieties of polishing wheels, the type used depending upon the class of work. Wooden wheels covered with leather to which emery or some other abrasive is glued are employed extensively for polishing flat surfaces especially when good edges are to be maintained. The abrasive numbers generally used for roughing ordinarily range from No. 20 to 80, for dry finishing from 90 to 120, and for finishing 150 to X. F. For finishing they are first used or worn down a little, and then tallow or beeswax, or oil is used on the abrasive wheel to secure the finish.

To remove the old emery from the wheels use pieces of pumice stone.

To renew the wheels with emery clean off thoroughly and use the best grade of glue and apply at the correct constituency. Roll wheels in emery by using a piece of round stock or pipe in the hole of the wheel and revolve by applying pressure.

Any of the polishing supply houses that advertise in The Metal Industry can furnish you with these wheels, and the proper grade of glue, and also the emery.—P. W. B. 3,132.

SPOTTING OUT

Q.—My brass plating is spotting out. How can I stop it?

A.—We can only repeat, as we have done so many times, covering the spotting-out problem.

Much more care must be used in washing and drying plated articles in the summer time than in the dry atmosphere of winter.

Wash repeatedly in cold and boiling water. To the boiling water add ⅛ ounce of phosphoric acid per gallon. After thoroughly washing the articles dry out in maple wood sawdust. Then dry again by the aid of heat at a temperature of 200-212 deg. Fahr.

We cannot inform you at the present writing who can furnish you with crimped wire German silver and brass scratch brushes with metal hubs instead of wooden ones.

There is no doubt that scratch-brush manufacturers advertising in The Metal Industry can furnish you with such brushes. Try the Sydney Blumenthal Company, Centre street, New York. Why don't you have steel caps spun up to fit the hubs with the necessary holes. Have them slightly hard so that they will not bend. If the wooden hubs are too large for the caps, the hub can be turned down a little on a taper, so that a driving fit can be made. The hub so protected should not split, due to the action of the brush water that swells the wood, and finally splits in redrying.

The steel caps can be used over and over again, if care is used.

We might also add, keep your cyanide down as low as possible, and add a small amount of sal ammoniac to your solution occasionally. These factors help to reduce spotting-out to a minimum.—C. H. P Problem 3,133.

ZINC ON SPRING STEEL

Q.—We are having trouble in electro galvanizing steel aircraft fittings. After lying about for a few days the plating blisters very badly.

We have tried reducing the current; keeping the fittings in acid solution for a greater length of time (although specifications permit the steel to be in the solution for fifteen minutes at the most as the acid tends to make the steel, especially spring stock, very brittle; keeping them in boiling water for a length of time, and have changed the acid solution. We are using a cyanide solution in the plating vats.

A.—It is possible that sodium fluoride will greatly assist you in getting much better results with your present solution. You can use up to two ounces per gallon.

An addition should also be made of corn syrup, such as brown Karo, 1 ounce per gallon.

If it is possible to cleanse the spring-steel articles without the use of acid you can avoid brittleness and blistering. It is the hydrogen gas that becomes occluded in the steel that causes your trouble.

If the articles can be tumbled use a solution of water and soda ash 58%, 4 ounces of the latter per gallon of water. If there is scale upon the steel from hardening, then use sea sand or some form of grit. Even cinders from coal ashes will answer the purpose.

The idea is to prevent the use of any form of acid whatever. Plate directly after tumbling. Merely wash the cleansed steel in water.

If there is a possibility of the steel occluding hydrogen gas from the zinc plating solution, then after plating the articles wash thoroughly in cold and boiling waters. Then heat at 300 deg. Fahr. for two or three hours until the hydrogen is slowly forced from the steel by expansion.—C. H. P. Problem 3,134.

PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST

1,418,303. June 6, 1922. **Aluminum Alloy.** Horace Campbell Hall, of Derby, England, assignor to Rolls-Royce Limited, of Derby, England, a company of Great Britain.

This invention consists of improved aluminum alloys. According to this invention an alloy is made consisting of:

Copper about .1% to any amount below 3%.

Titanium about .1% to about 2%.

Zinc about 6% to about 16%.

Iron (present as an impurity of commercial aluminum) preferably not exceeding .6%.

Silicon (present as an impurity of commercial aluminum) preferably not exceeding .4%.

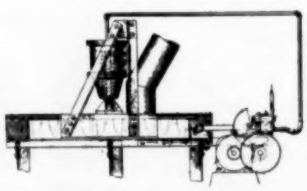
Other elements (impurities) preferably not exceeding .4%.

Aluminum remainder.

1,417,896. May 30, 1922. **Electrodeposition of Metals Upon Iron and Alloys of Iron.** Robert Joseph Fletcher, of London, England, assignor to the Fletcher Electro Salvage Company, Limited, of London, England, a British Company.

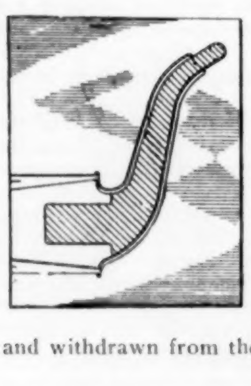
This invention relates to the electrodeposition of nickel, iron, cobalt and other metals upon the surface of iron or alloys of iron, such as ordinary or special steels, and more especially to the method of cleaning the iron so that a firm and coherent coating of the deposited metal can be obtained direct upon the iron surface.

1,417,568. May 30, 1922. **Molding Machine.** Thomas A. Reynolds, of Grafton, Pa., assignor to the McConway and Thorley Company, of Pittsburgh, Pa.



The invention relates to a molding machine and has for its object to produce a simple and efficient apparatus by which molds or cores can be rapidly and economically made. The principal features of the invention are embodied in an organization involving a chute for delivering the molding sand to an alined sucession of mold boxes which are intermittently moved from beeath said chute into operative relation with a fluid pressure controlled ramming device by which the sand is pressed in the boxes, the operation of the ramming device being controlled by the movement of a valve which is operatively coordinated with the means by which the mold boxes are shifted.

1,416,412. May 16, 1922. **Die-Casting Process.** Charles Pack, of New York, N. Y., assignor to Doehler Die Casting Company, of Brooklyn, N. Y.



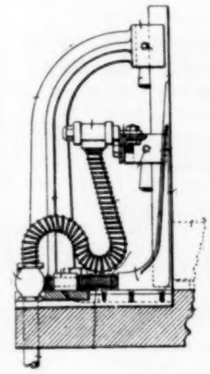
One of the objects of this invention is to provide a process for casting under cuts in die-casting, and my invention, which is thought to be broadly new, primarily consists in casting the desired under cut in die-casting about a mold unit or core of material having a fusing point lower than that of the alloy used for the casting, so that after the casting has set, by aplying heat sufficient to melt the unit or core, but not sufficient to melt the casting, the unit or core may be melted and withdrawn from the casting.

1,409,017. March 7, 1922. **Aluminum Plating.** Ruselmo Ortiz, of Bayonne, N. J., assigned to General Electric Company, Schenectady, N. Y.

Previous attempts to produce an aluminum coating on iron or steel articles by the hot-dipping process have resulted in a very rough surface (due to corrosion at very high temperature), or a coating consisting not of pure aluminum but an aluminum-iron alloy (when working at moderate temperatures). He proposes first to clean the steel article by pickling in 50 per cent. ammonium citrate, washed and dried. Then it may be covered with a flux—a mixture of KCl, NaCl and $ZnCl_2$ melting below 600 deg. C. The aluminum is melted under a reducing atmosphere, held at 650 deg. C. or somewhat higher, and skimmed. The iron article is dipped into the bath at a rate just great enough so that the meniscus, where the aluminum wets the iron, is neither destroyed nor inverted. Its presence proves the wetting of the iron by the aluminum, and insures that oxides or dirt at the junction will be removed from the contact. Under these conditions the steel will join to a smooth aluminum coating through a transition alloyed zone.

1,416,439. May 16, 1922. **Wing Bung for Melting Furnaces.** Donald S. Barrows, of Rochester, N. Y.

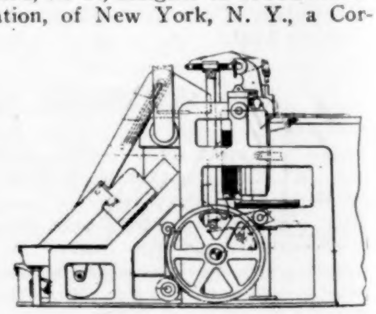
The invention, broadly stated, relates to furnaces and more particularly to improvements in the construction of one or more of the removable roof members used in that type of furnace which is adapted to re-melt pig iron with steel, cast iron or malleable iron scrap, the re-melted metal being used in the production of grey or malleable iron casting.



1,417,577. May 30, 1922. **Core Making Machine.** Olof Skeppstedt, of Moline, Ill.

My invention relates to core making machines, and has for its purpose to impart a vibratory movement to the core box, in order to thoroughly loosen the cores, to permit the removal of the box therefrom. This has usually been done by hand, with the expenditure of considerable time, and not always with satisfactory results, as the operation, when performed by hand, is not always uniform.

1,418,418. June 6, 1922. **Metal Supplying Device.** Henry A. Wise Wood, of New York, N. Y., assigner to Wood Newspaper Machinery Corporation, of New York, N. Y., a Corporation of Virginia.



The principal objects of the invention are to provide a construction for this purpose with improved means for delivering cast plates, discarded tails and pigs of metal into the melting pot timed with respect to the operation of the pump so as to keep the supply proportionate to the amount of metal discharged; to provide for moving the tails on their straight edges throughout their course of travel after they are severed; to provide the gravity chute down which they slide with projections so placed as to turn the tails around while still in the chute; to provide improvements in the elevator for moving the tails up to the top of the metal receiving pot; and more specifically to provide a double chain elevator and a guide for the tails therein.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

Madsenell Nickel

Some of the Properties of This Malleable Nickel

By L. J. BUCK, British-American Nickel Corporation, Ltd.

The physical properties which most articles of manufacture should possess in the final form are well understood, but the properties which determine the practicability and the cost of producing them are not commonly known. One reason is that the terms "malleability" and "ductility" are relative only, and no direct measure of hardness is known. Malleability and ductility are usually considered synonomous, but they are not. The former is much the older term and means that the article will stand mal-formation. A metal is said to be malleable when it can be slightly bent or slightly formed. But it may not necessarily be ductile. Ductility, on the other hand, means the ability of a metal to flow under pressure like putty or plastecine. A metal which is ductile must therefore always be malleable also, but a metal may be malleable when it is not ductile. Therefore, the latter term is the more important. No quantitative measure for malleability has been devised. It has been customary to call a metal malleable when so made as to stand slight bending, which was formerly brittle. If the art is improved the metal is simply still more malleable.

We have adopted an arbitrary scale of testing which gives a rough idea of the degree of malleability. The test consists in making a dead sharp bend which is hammered down flat and sharp, then straightened out and hammered flat, then bent back in the same place in the same manner, and hammered out again. If the metal stands this test it is called grade "A." The complete key is as follows:

A—2 sharp bends and straightening.
B—2 " " but cracks on second straightening.
C—1 " " and straightens but cracks on second bend.
D—1 " " but cracks on straightening.
E—Cracks on completion of first bend.
F—Cracks before first bend is made.

This test is rough, of course, but seems to be consistent, on thicknesses up to 1/6 inch. All Madsenell* nickel will give an "A" test before heating. The only other metal which will do so is gold. Other nickel tested gave grade "C" test; copper equalled grade "C" and brass grade "D."

Many metallurgists have adopted the Ericson machine test, as a measure of ductility. This test consists in putting the sample over a hole and pushing a steel ball into it until the sample cracks. The degree of ductility is then expressed in the comparative heights of the mounds so formed in terms of millimeters. On this test, using samples .020" thick:

Ordinary brass	5 millimeters
Domestic malleable nickel	6 "
Ordinary copper	7 "
Dead soft drawn Lake copper	12 "
Madsenell nickel	16 "
Pure gold	18 "

A more direct measure of total workability which comprises both malleability and ductility is obtained by determining the elongation factor. This is the difference between the "elastic limit" and the "ultimate strength." The "elastic limit" is the first yield point when the sample is pulled in the Olesen machine, and the "ultimate strength" is the break. The yield point of Madsenell nickel is 52,000 pounds per square inch, and the "ultimate strength" 72,000 pounds per square inch. The difference shows the amount of work which can be done on it. This may also be more exactly expressed in terms of per cent elongation.

The per cent elongation of	Madsenell nickel is	32%
" " " "	Copper	" 24%
" " " "	Brass	" 12% to 15%
" " " "	Bessemer steel	" 10%
" " " "	Tool steel	" 5%

*An unbreakable nickel developed by C. P. Madsen, 33 East 17th street, New York.

This relative percentage of elongation may be taken as a direct comparative expression of the relative amount of cold working which can be done upon the metal, until the strains set up in it equal its elastic limit. When this happens the metal is brittle.

A practical idea of what these figures mean can be obtained from practical wire-drawing tests. Madsenell nickel has been drawn from ⅛" iron rod to .002" without annealing. Copper would have to be annealed at least three times, brass five times and steel ten times in this reduction.

ANNEALING

Annealing is the name of the heat treatment given metals calculated to restore their physical properties after they have been altered by cold working. In general, the cold working of any metal raises its Brinnell hardness and lowers its elongation. The Brinnell hardness alone does not disclose when the limits of workability have been reached, unless such hardness figures have been co-related with the elongation per cent. When the elongation per cent. reaches zero, the metal is brittle and can be worked no further. Annealing is performed differently for different metals. Nickel is usually heated to a cherry red heat and plunged in water. If sufficient temperature is reached no appreciable time is required. If the temperature be too low the treatment must be prolonged, and if too high the metal will be embrittled by absorbed oxygen. Because of the high elongation factor, therefore, great workability of Madsenell nickel, it should rarely be necessary to anneal in order to work further. There are, however, two cases in which the fully annealable metal is desired.

A—Those which are required to be soft after having been cold-worked.

B—Uses in which the article must retain high strength after or during exposure to high temperatures.

As an example of the former might be given that of wire for weaving cloth. There is usually no objection in finished articles to a wire which is hard and strong, but certain types of weaving machines can work with a wire which is dead soft only, and which will lie like an ordinary cotton thread. As an example of the latter may be given chemical retorts or high pressure steam boilers.

Madsenell nickel is unique in its annealing properties. While it tests "A" before annealing and its Brinnell hardness is restored to its original value upon annealing the degree of malleability possessed after annealing is not necessarily grade "A" as referred to in the arbitrary scale previously mentioned.

Most of the metal manufactured commercially to date is equivalent to grades "B" and "C" in the scale although nickel of grade "A" has been and can be manufactured.

COST FACTORS

Two important cost factors in addition to the base cost of the raw metal are

1—Cost of finishing
2—Cost of forming

The cost of finishing, particularly the metals which require plating, is always far higher than is supposed. It often happens that the total cost of finishing and plating a steel article is ten times the cost of the metal in the article, and the cost of plating and finishing a brass article is often equal to that of the cost of the raw metal in the article, and sometimes two to four times as great. It can therefore often happen that the final cost of making even a common article from pure nickel will be less than that of making the same article from either steel or brass which must afterward be highly finished and plated. Only a complete analysis of the total cost factors for each article can determine this fact.

A factor in the total cost of production not commonly under-

stood is variation of properties of the material. In other words, it not only costs more to fabricate an article from a metal having an elongation factor of only ten per cent than it does from a metal having an elongation of 30 per cent, but any variation in the different lots of the metal from the supposed elongation factor increases the cost enormously, often to the extent of making the difference between success and total failure.

To make this clear the fact should be visualized that the forming die is built to fit the metal that it is to work. This is more of an art than a science, and although many modern shops are attempting to use formulas for the construction of dies based upon laboratory tests of metal, most shops build a forming die by experimenting with a sample of metal. When the die is finished, it will work only metal just like the sample. If different lots of metal vary from the sample, the die not only will not work properly, requiring, therefore, a great deal of expensive tool work, and loss in operatives' time by the resulting delay, but also the die may be ruined by the metal.

Heretofore there has been some prejudice against malleable nickel on the part of metal works either through difficulties experienced because of variance of the physical properties of the metal received or through the ruining of dies designed for the working of brass.

Madsenell nickel made by an electrolytic process and susceptible to the most accurate control, makes possible the manufacture of a metal possessing all the chemical properties of ordinary nickel with unique and uniform characteristics which will make it a commercial product of wide application.

METAL PARTS WASHING MACHINE

The Crescent Metal Parts Washing Machine, made by the Crescent Washing Machine Company, New Rochelle, N. Y., used by the Crane Company is the culmination of approximately four years of plan and study of the washing needs of the metal industry. Heretofore, the general line of Crescent Metal Parts Washing Machines has been small, compact, self-contained units, each unit complete in itself. This is called the flexible unit plan of washing. By this method a plant can localize or centralize its washing as it sees fit. Any machine by a few minor changes can be made into a wash unit or a rinse unit. If washing and rinsing are required as successive operations two machines are used in dual arrangement. As many as four units in line are now in use. Among the more noteworthy installations are those in the Eastman Kodak Company, the Harley Davidson Motor Company, the National Enameling and Stamping Company, the Yale & Towne Manufacturing Company, the Burroughs Adding Machine Company, and others.

While the flexible unit plant of washing has answered the needs of perhaps 75 per cent of the plants in the metal industry there is a minority that has had need of a machine of greater capacity, in which the washing and rinsing are done in one chamber, closely followed by a separate drying operation wherever needed.

Plants washing parts, in number from 50,000 to 100,000 and above per day, or tons in weight of screw machine products per day, have need for machines of this volume.

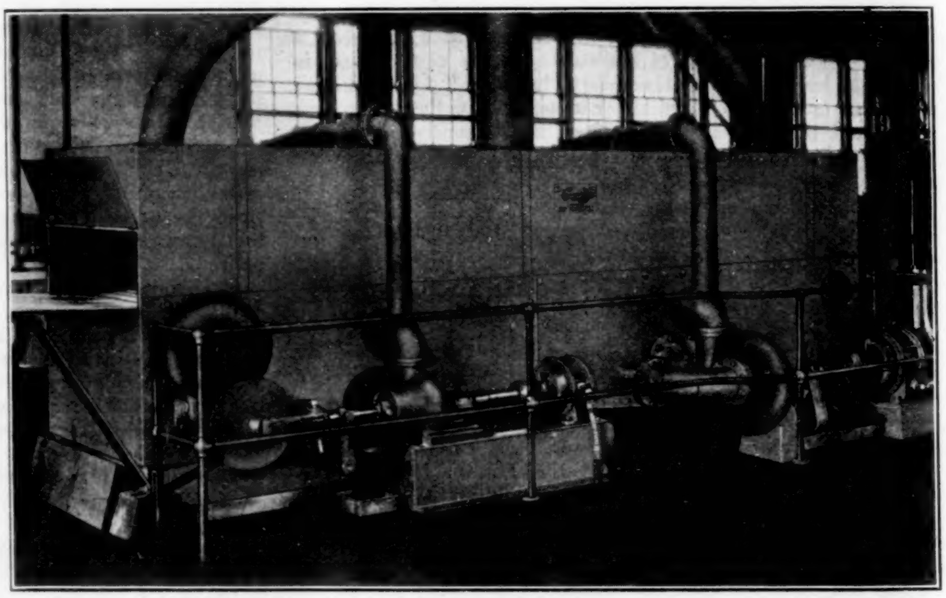
This particular machine is 16′ long, has a 34″ working level and is 5′ 3″ high. It will clean an object 24″ deep, 40″ wide and if necessary, as long as its length. Its total width is 4½′. In the wash chamber are four sets of two arm upper and lower revolving wash units. The upper and lower wash arms of each set rotate at an angle affording a cutting, stripping action with much the effect of an hydraulic gun. This is what is known as the Crescent Revolving Wash process, a patented idea. The Crescent water action is essentially water under pressure of a centrifugal pump. The pump feeding the wash arms throws 1,200 gallons of water a minute and is driven by a 15 horsepower motor.

Located at an approximate distance of 6½′ from the wash unit are two sets of upper and lower revolving wash units throwing 400 gallons of fresh rinse water or rinse solution, as the conditions demand, an hour, driven by a three horsepower motor.

In washing small objects, such as stampings, screw machine products and the like, they are placed in racks made of wire mesh, (to suit the requirements) laid over pressed steel frames. In the smaller unit described above, one rack can be fed into the operating end of the machine at a time. In the large Crescents used by the Crane Company two racks can be fed at a time, side by side. The racks measure 18″ by 24″.

The latest report from the Crane Company, it is stated, is that the machine in operation there is washing several hundred thousand pieces per day. This machine was primarily designed to meet the requirements existing in the automotive industry. At the time, this company was asked to build machines for prominent automobile manufacturers to wash such objects as rear assemblies, crank cases, cylinder blocks, radiators and in certain instances, chassis frames. Certain classes of work call for water action of great force and volume, the latter being more important for the quick and effective cleaning of metals than the former.

The body of the machine is made of No. 10 gauge steel plate supported throughout its length by 6″ channels. It is ruggedly built and should last for years.



CRESCENT WASHING MACHINE

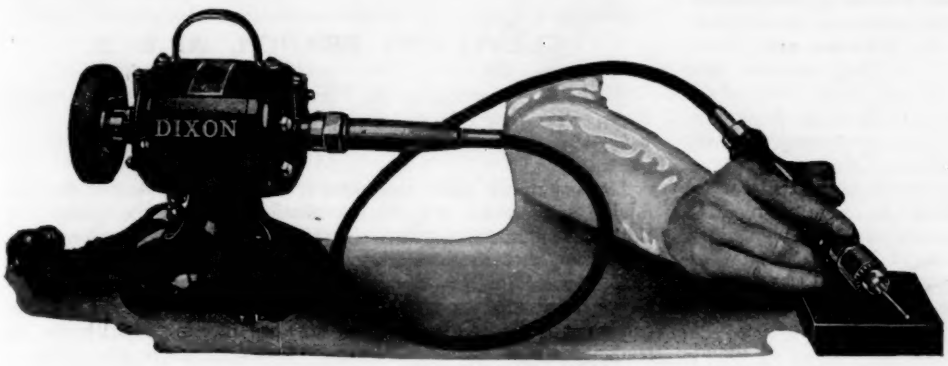
CENTRIFUGAL CASTINGS

The American Manganese Bronze Company of Holmesburg, Phila., Pa., has announced the marketing of centrifugal castings of bronze, brass and aluminum, made by its own process (patents pending). It is stated that the ordinary defects of sand castings, such as sand holes, blow holes and mismatching are eliminated.

Among the more common applications of this process are bushings, bearings, pump liners, cylinders, gear blanks and rings. The following points of superiority are claimed: No sand holes; no blow holes, no mismatching; close grain; greater strength; greater resistance to wear; greater resistance to acids; reduced machining costs; fewer defective castings, and reduced machine work scrap.

NEW FLEXIBLE SHAFT

In our issue of August, 1922, page 325, we described the new flexible shaft for jewelers and die-sinkers, made by William Dixon, Inc., 119 Fulton Street, New York. At that time illustrations were not available but they have since been received.



DIXON FLEXIBLE SHAFT CONNECTED TO MOTOR

DIXON FLEXIBLE SHAFT

It is noteworthy that with all the advantages claimed, the outfit is said by the manufacturers to sell for less than any similar outfit that was offered before.

NEW PICKLING COMPOUND

Sumfoam Compound is an organic compound said to be completely soluble in an acid solution about which the following claims are made. One part in eight to ten thousand is sufficient to produce surface tension in the solution, causing the escaping hydrogen produced through the action of the acid on the metal, to produce a foam on the surface of the solution. This foam either heavy or light acts as a filter, permitting the hydrogen formed in the solution to escape but holding back the spray of fume which is damaging to the health of workmen, buildings and finished product in the vicinity. How obnoxious and destructive these fumes are is well known to all those who operate a pickling process.

If the foam is heavy, or relatively so, it acts as an insulator, keeping the cold air away from the hot solution, in the winter months, thus greatly reducing the fog in the pickling house, and reducing danger to workmen. The acid loss through fumes and entrained with steam is not usually great. Where sulphuric acid is the substance used the acid is not volatilized but removed from the tanks mechanically. If the acid is nitric, hydrochloric or hydrofluoric, there may be acid volatilized unless caught and held in the solution by means of the surface tension produced by Sumfoam.

The suppression of fumes is only part of the savings claimed for the use of Sumfoam. It is said to protect the cleaned metal from the action of the acid after the scale removal, resulting in a smoother surface on the metal and a reduction in the quantity of acid required for cleaning, amounting to 20 per cent. to 25 per cent. This acid saving results in a metal saving equal to what the saved acid would have dissolved; with 66° sulphuric acid this amounts to half the weight of the acid.

Sunfoam being an organic compound is slowly destroyed by strong hot acid solutions and must be replenished at intervals of two to four hours.

It is claimed that a test made by one manufacturer, ten gallons of Sunfoam Compound, costing him $5.00, saved six tons of 66° sulphuric acid worth $96.00, and three tons of product worth $204.00, besides several hundred pounds of spelter. Another manufacturer reports having cut his galvanizing cost 15 per cent on the acid and spelter saving alone.

Sunfoam is said to be used over this country and abroad in all kinds of pickling operations. It is made by The Hoffman Process Company, 1414 Park Building, Pittsburgh, Pa.

BARREL TYPE MELTING FURNACE

The Hausfeld barrel type non-crucible furnace is said to be especially designed for the melting of scrap metal and has a capacity of 2,000 pounds per heat, either gas or oil fuel. The superior feature claimed for this furnace is the design of the burner and the oil spray.

One hundred and nine heats were melted totaling 219,645 pounds composed of the following:

Heavy copper	52,904
Light copper	5,307
Red brass scrap	1,005
Miscellaneous red & yellow turnings	8,569
Miscellaneous red & yellow borings	72,965
Heavy yellow brass scrap	27,284
Light yellow brass scrap	16,433
Tin	4,229
Lead	2,835
Zinc	7,846
Brass grindings	2,094
Wash metal from ashes	12,006
Brasss condenser tubes	5,295
Miscellaneous scrap sweepings, etc.	873
	219,645
Metal recovered	204,181
Shrinkage	5,464

Loss due to shrinkage 7.04 per cent.
Production—8,000 pounds per day requiring two men.

ASSOCIATIONS and SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

BRASS MANUFACTURERS

The National Association of Brass Manufacturers adopted the following resolution at the meeting in Detroit, September 8:

Resolved, that the National Association of Brasss Manufacturers are strongly in favor of action being taken to correct the present day evil in the practice of applying red and white lead and other such harmful products to the inside, or so-called female threads of pipe fittings and other threaded joints in plumbing work.

The result of this practice is to spread throughout the water piping system, a large amount of residue lead and other poisonous ingredients which contaminate the water for a period of time after installation, to the great detriment of the public health.

It is our belief that this subject should be brought to the attention of master plumbers that they may change this harmful method in the use of red and white lead and other compounds and that they instruct their workmen to use only such amount of joint compound as is actually necessary and to be applied only to the male thread of fittings, etc. As an aid to the efforts of master plumbers, we believe this matter should be brought to the attention of Public Health Boards and Commisssioners of Public Health, to secure a ruling in each and every community, by legislation if necessary, to have this harmful evil eradicated.

AMERICAN ELECTROCHEMICAL SOCIETY

The first session of the coming meeting of the American Electrochemical Society was held on Thursday, September 21, at 10 A. M., at the Windsor Hotel, Montreal. The session was devoted to papers on Electrolytic Iron, Zinc and Nickel. Mr. Norman B. Pilling, of the Westinghouse Electric & Manufacturing Co., of Pittsburgh, carried out an extensive investigation on the Effect of Heat Treatment on the Hardness and Microstructure of Electrolytically Deposited Iron, and reported upon results obtained. Messrs. R. P. Neville and J. R. Cain, of the Bureau of Standards, prepared a series of alloys of electrolytic iron with carbon and manganese, using a vacuum furnace; they measured the mechanical properties of these alloys.

At the University of Wisconsin, research has been carried out on Electrolytic Zinc, and Mr. Ralph B. Abrams reported upon his experiments on the De-zincification of Brass, while Mr. Walter G. Traub discussed the Diffusion of Electrodeposits into Zinc. The Effect of Single Impurities on the Deposits of Zinc from Sulphate Solutions was ready by Mr. John T. Ellsworth, of Park City, Utah.

M. R. Thompson and C. T. Thomas, of the Bureau of Standards, carried out an investigation on the Effect of Impurities in Nickel Salts Used for Electrodeposition.

A very ingenious little piece of apparatus, called the Contractometer, has been developed by Mr. Ernest A. Vuilleumier, who presented to the Society the results obtained in the use of this apparatuss in the Study of Electrolytic Nickel Deposits.

The sessions on Thursday afternoon and Friday morning were devoted to papers on Industrial Heating, including the subject of enameling and coloring of metal parts.

NEW YORK BRANCH, A. E. S.

The regular meetings of N. Y. Branch, A. E. S., were held at Broadway Central Hotel on September 8, President Morningstar presiding, and on September 22, Vice-President Wm. Fischer presiding. At the first meeting papers were read on Nickel Plating, Zinc Deposit on Steel Bumper Bars, Separation of Gold and Platinum, and rust-proofing iron and steel. A zinc name plate was exhibited showing an intense black on the zinc; formula and procedure explained. At the September 22 meeting nickel plating, black and white on aluminum was discussed; formula given for direct plating on aluminum.

CLEVELAND BRANCH, A. E. S.

At the last meeting of the Cleveland branch Saturday, August 26th, President Scott appointed a committee to devise ways and means in connection with the holding of our annual banquet.

The committee after considerable discussion presented the following suggestions and recommendations: That the banquet be held November 18, which is the third Saturday of the month. In connection with the banquet to boost the Cleveland branch and to make a drive for new membership (also to secure a maximum attendance at the banquet) we recommend that we follow the precedent of last year and hold an open meeting inviting the attendance of interested manufacturers from the whole city of Cleveland and such places out of town as we can consider in our jurisdiction. This meeting could be held two weeks before the banquet, namely, on November 4, the first Saturday of the month. We expect to feature this meeting very strongly and send out at least 400 invitations. As a feature of that evening we would stress the educational value. As the main attraction at this meeting we have to submit M. G. Kopf, Research Engineer of the Davis Sewing Machine Company, of Dayton, Ohio, who is a member of the society and has done some very fine work at the Detroit and Dayton branches. He was also on the program at the Annual Convention at Cincinnati. At our meeting a letter was read from Mr. Kopf in which he offered every effort in his power to make such a boosters' meeting successful. His talk will be very illuminating covering as it does the subject of conservation in connection with the prevention of corrosion and its causes, and it is illustrated by lantern slides.

Deaths

SAMUEL H. DOUGHERTY

Samuel H. Dougherty, western representative of the Jonathan Bartley Crucible Company, died in Mount Vernon, Ohio, September 11, 1922.

HUGH McPHEE

Hugh McPhee died in the Bridgeport Hospital, Bridgeport, Conn., July 28, 1922, after a severe illness due to heart trouble.

Hugh McPhee was born in Glasgow, Scotland, in July, 1858, and came to the United States when he was 14 years old. He learned his trade as molder with his father, Duncan McPhee, and with him worked in many foundries throughout New England. For many years he conducted a brass foundry in Lowell, Mass. In 1897 the foundry was destroyed by fire. In the spring of 1898 he came to Bridgeport, Conn., and took charge of the Deoxidized Bronze & Metal Company. About 1900 he became foreman of the Eaton, Cole & Burnham's Brass Foundry, which specialized in valves and fittings. In 1906 he visited Scotland, and incidentally went to Sweden, Austria and Germany in the interest of the Rockwell Furnace Company.

HUGH MC PHEE

In the fall of 1908 he went to Montreal, Can. He found the following winter too severe for his liking, and left in the spring of 1909 for Jackson, Mich., where he took charge of the Buick Motor Company's foundry. The Buick company at that time was preparing to move to Flint, Mich. Mr. McPhee established their new foundry there at Flint, and then went to Tarrytown, N. Y., and became superintendent of foundries in 1910 for the Maxwell-Briscoe Company. While at the Maxwell plant, he perfected an ingenious method of molding loose patterns on plate (described in an article published in THE METAL INDUSTRY, May, 1910).

In 1912 he established a foundry of his own in Tarrytown. In the spring of 1913, business was progressing satisfactorily when the most serious accident of his career occurred. An explosion of molten metal occurred when he was placing mixtures in a pot of aluminum. Metal entered both of his eyes and it was thought that he would be blind the rest of his life, but the sight of his right eye was saved, although the left eye had to be removed. Ever since that accident he was not quite the same. He was naturally proud and took a great deal of care in his personal appearance, but the disfigurement caused by the loss of his eye made him grieve and no doubt materially shortened his life.

He recovered sufficiently, however, to accept the management of the Kelley & Jones Foundry in Greensboro, Pa. From there he went to the Pratt & Cady Foundry in Hartford in 1914. In 1915 he acquired an interest in the Springfield Foundries Company at Springfield, Vt. In 1916 he took charge of the Neptune Meter Company's foundry, Long Island City, where great quantities of shrapnel were made. At the close of the war, in 1918, he became foreman of the Norwalk Brass Foundry. During the years 1919, 1920, 1921 and 1922 he had lesser charges in Bridgeport, Conn.

He took an active interest in the Foundry Foremen's Association, and for many years never failed to attend their conventions. He had a very wide acquaintance among men associated with the foundry business. He leaves a wife and son in Bridgeport, Conn.; a son in Scranton, Pa., and another in Fall River, Mass. His brother, Alexander, who has often assisted him in his various positions, is in charge of a large foundry in New Brunswick, N. J.

PERSONALS

L. J. Krom announces that he has established an office at 50 Church street, New York City, for the purpose of carrying on a consulting metallurgical and engineering practice which will be devoted to the production and consumption of metals and alloys. The service includes:

The planning of and supervising the construction of rolling mills, foundries and casting shops.

Investigations and reports on the conduction of rolling mill and foundry operations with the view of reducing overhead and production costs.

The solving of metallurgical problems occurring in daily manufacturing practice.

Acting as advisor to consumers of metals as to the proper application of metals and alloys.

Mr. Krom's qualifications for delivering the proposed service are based upon fifteen years of practical experience as chemist, metallurgist and works manager in brass, copper and aluminum manufacturing plants, and eleven years as managing editor and consulting metallurgist with The Metal Industry.

M. F. King, formerly of the Kings Refractories Company, has joined the sales and service department of the Quigley Furnace Specialties Company. Mr. King brings to the Quigley organization the benefit of his wide experience in the application of refractories and high temperature cements, and will devote his attention to service and sales work in New York City.

W. C. Allen, who has been in charge of the Chicago Branch of the Black & Decker Manufacturing Company for the past year, has been appointed Sales Supervisor for the Black & Decker Manufacturing Company.

In order to release Mr. Allen for his new work, **R. S. Mitten,** has been appointed Branch Manager for the Black & Decker Chicago territory. Mr. Mitten was formerly Sales Manager of the Electric Appliance Company, Chicago, and will be "among friends" in his new capacity.

NEWS OF THE INDUSTRY

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

WATERBURY, CONN.

October 2, 1922.

The prosperity waited for two years and for a year announced to be right around the corner has at last arrived. The **Chase Metal Works, Chase Rolling Mills, Scovill Manufacturing Company and American Brass Company,** announced this month an increase in the hiring rate of common labor from 30 cents to 35 cents an hour, and stated that the wages of those at present employed would be increased correspondingly, but on an individual basis. The other factories of the city are expected to fall in line, and in fact many of the smaller factories, through the shortage of labor, had been forced to make the standard rate for common labor 35 cents an hour prior to the raise given by the four largest factories in the city.

The American Pin Company, Randolph-Clowes Company, Waterbury Manufacturing Company, the Mattatuck Manufacturing Company and the Novelty Manufacturing Company stated that a similar increase in wages was being considered by them. It has also been announced that the **Anaconda Copper Mining Company** has granted an increase of 50 cents a day to its common labor.

"Shortage of labor caused by restriction of immigration imposed by Congress and the returning of prosperity is responsible for the wage adjustment," is the way the factory officials put it. The report of the Connecticut Bureau of Labor and the Connecticut Manufacturers' Association states that labor in the state and especially around Waterbury is very scarce, although a few months ago there were thousands out of work. The shortage is so acute in the State that more than 1,000 unskilled laborers could be given work immediately, the report states.

Sweeping changes in the personnel, particularly among the higher officials, of the **American Brass Company** will it is rumored, be made by the end of the year, probably due to the control of its stock by the **Anaconda Company.**

The resignations of six of the higher officials have been made to take effect January 1st. The men are **Milroy Steele,** president of the **Waterbury Brass Goods Corporation,** a subsidiary; **James L. Smith,** treasurer of the Waterbury Brass Goods Corporation; **John P. Elton,** vice-chairman of the board of directors and first executive vice-president of the American Brass Company; **Arthur M. Dickinson,** executive vice-president of the American Brass Company and manager of the Waterbury branch; **Gordon W. Burnham** and **Thomas B. Kent,** executive vice-presidents. It is considered probable that many more changes of officers subordinate to these, will be made by the first of the year. All the resignations were made voluntarily, but the underlying reason is said to be that the officials have been relieved of certain responsibilities by virtue of the merger last spring of the Brass Company with the Mining Company.

Positive denial was obtained that **Charles F. Brooker,** chairman of the board of directors had tendered or was about to tender his resignation. A special meeting will probably be called in December to act on the resignations. The six officials are the leaders in the local industry and have held large interests in the concern. They have been activly identified with the brass industry in the valley for many years.

The Manufacturers' Association gives Waterbury's fuel supply as follows: Tons on hand, hard—5,762; soft—43,970. Tons en route: hard—411; soft—10,600. Future delivery: hard—1,405; soft—35,673. Needs per week: hard—1,306; soft—5,389. Factory officials in general express the opinion that there will be no closing down of factories as was the case with the Ford companies. The American Brass Company's officials stated that they had plenty of coal on hand that there was no cause for worry at their offices. **William J. Larkin,** vice-president of the **Waterbury Clock Company** said the company had several months supply on hand. The **Connecticut Light and Power Company,** which supplies the power to many of the local factories has a two months supply on hand.

Many of the factories are endeavoring to substitute oil for coal. The American Brass Company's plant at Ansonia has been fitted with a 900,000 gallon tank for the storage of fuel oil which will eventually replace coal bins. Many of the larger factories have been gradually replacing coal furnaces with oil for some time. While the smaller factories have not yet begun many of them state that they are considering it.

President **Howard F. Baker** of the **Eastern Brass and Ingot Corporation** of this city, a so-called "war baby," now in the process of liquidation refused to come to Waterbury to be examined in the case certain creditors are bringing against the concern so Attorneys John H. Cassidy and L. L. Lewis went to Washington to take his depositions. Their report will be presented to Judge Thomas of the bankruptcy court. President Baker admitted having drawn $10,000 a year as president up to March, 1922, and that the secretary-treasurer drew $6,600, and that this continued even when the working force of the plant had been reduced to less than six men. Testimony was offered showing that the company spent $92,000 more than it realized through the sale of bonds and also $15,000 which it borrowed from local banks. It kept going until its funds were gone and credit exhausted according to the testimony. George Dalby was appointed receiver by agreement with the Central Trust Company of Illinois so that the creditors who were pressing the

company would not attach the property and so force the company into the bankruptcy court. The contention of Attorneys Cassidy and Lewis, representing these creditors is that the proper place for the concern is in the bankruptcy court and are bringing this action to compel such disposition.

The Sterling Watch Company has been formed to manufacture the Pastor Stop watch, recently invented by Thomas Pastor of this place. The invention is an attachment which is fitted to the back or top plate of a watch. It is driven by the main spring of the watch yet it is separate and distinct from the watch train. It is brought into action and stopped without affecting the watch as a timepiece. A watch having this attachment is always a perfectly good time piece, having the split second and stop watch features as an auxiliary.

The inventory of the estate of the late **J. H. Bronson,** brass manufacturer, shows 1,737 shares of Anaconda stock, 300 shares of American Pin, 500 shares Waterbury Clock, 216 shares Scovill Manufacturing, 156 shares Waterbury National Bank, 1,146 shares Waterbury Gas, 1,400 shares Oakville Company, and stock in many outside concerns. His stock holdings totaled $1,012,627, bonds $171,007.32, mortgages $5,882, notes $2,500, real estate $71,100, cash $4,375, miscellaneous $15,224, a total of $1,282,715.

The diversity of products in the city is shown by the recent census report, giving the number of manufacturing concerns here as 253, employing 34,651 persons, having 167 firm members, 1,212 salaried officials, and 2,950 clerical workers. It shows that 51 per cent of the brass, bronze and copper products of the state are made in Waterbury, over 50 per cent of the needles, pins and hooks and eyes and 66 per cent of the buttons. There are 21 brass, bronze and copper concerns here, five needle, pin and hook and eye concerns, 24 foundries and machine shops, three bronze engraving concerns and three machinists' tool concerns.

A new concern known as the **Cheshire Manufacturing Company** has taken over a small plant in Cheshire, and will commence the manufacture of small pocket radio boxes. It expects to spend $50,000 in extending and improving the plant. It expects to employ 100 hands by the first of the year. It is said to have received an order for 1,000,000 of these pocket radio boxes from a large radio concern.—W. R. B.

BRIDGEPORT, CONN.

October 2, 1922.

The report on local factory activities issued by the **Bridgeport Manufacturers' Association** continues to show a steady gain in employment, more hands being employed in the 31 leading factories than at any time since 1920. The present number of employes is 15,869 or 62.7 per cent of high normal. The number of man hours in the factories totals 780,261 or 62.9 per cent of normal and the highest total in two years. The average factory hours per employe and per factory is 49.2, the highest percentage in two years.

The hectic affairs of the war time plant, the **Liberty Ordnance Company,** later the **Morris Metal Products Company,** have about closed the factory and part of the properties having been purchased by the **Belknap Manufacturing Company.** The Morris Metal Products Company took over the factory and the property after the war, the Ordnance Company having closed down in 1919. The former company, however, never did much business and suit after suit followed during the next year accompanied by attachments. Finally the company was declared bankrupt in June of this year. Samuel Reich was appointed trustee by Judge John Keogh.

W. C. Durant, who recently took over the Locomobile Company and plant has announced that the price of the car will be increased to "permit of further refinement and improvement of the car and for greater elevation of the Locomobile standards. The motive plant will remain as at present and there will be no general change in the lines of the car or the principles of construction. The company will continue to market the car through its own branches, and the system will be amplified by direct dealers for territory not covered by branches.

The Winchester Repeating Arms Company after reporting a deficit in its earnings for the first six months of the year of $52,512 has adjusted its balance sheet as of June 30, showing total assets of $35,770,288.—W. R. B.

TORRINGTON, CONN.

October 2, 1922.

The Schroeder Brothers Manufacturing Company, which recently increased its capital stock, has filed a certificate of organization showing the following officers: President, Hugo C. F. Schroeder; vice-president, Ernest E. Schroeder; treasurer, Gustave A. Schroeder; secretary, Richard F. W. Schroeder; and assistant treasurer-secretary, Arthur E. R. Schroeder. The company manufacturers various metal products.

The net operating profits of the **Torrington Company,** of Connecticut, for the fiscal year ending June 30, 1922, amounted to $1,476,154 as compared with $662,518 in the preceding year and $3,807,953 two years ago.

John F. Alvord has been re-elected president of the Torrington Company of Maine. William R. Reid is vice-president and Clive B. Vincent, secretary and treasurer. A dividend of 2½ per cent. has been declared.

An advance of five cents an hour in wages of common labor went into effect at the Torrington Branch of the American Brass Company early in September.—J. H. T.

NEW BRITAIN, CONN.

October 2, 1922.

Manufacturing conditions insofar as they affect New Britain industries are excellent as the Summer months end and preparations for the summer months end and preparations for the winter begin; indications being that this coming winter will be one of the most prosperous that New Britain has seen in a number of years.

The Union Manufacturing Company, which had not gone back onto a full time schedule, has now increased its working hours. The **Corbin** factories, the **Landers, Frary & Clark** concern, the **Stanley Works,** the **Traut & Hine** company and others are all operating on full time, with plenty of orders ahead and excellent prospects of increasing both production and output during the winter months.

At the **North & Judd Manufacturing Company,** several departments have gone onto short time and others have curtailed their forces, but this is believed to be a direct result of the death of President H. C. Noble and a resultant possible change in policies rather than to a business depression.—H. R. J.

ROCHESTER, N. Y.

October 2, 1922.

For the first time since early last spring reports from various manufacturing plants using non-ferrous metals are of a more encouraging nature. Conversations with superintendents of several of the larger plants confirm the statement that the tide in the metal industry in Rochester has turned to the right.

It is true that the brass foundries have not been quite so busy in September as in August, possibly due to local conditions, but the plating plants have largely increased their output and prospects for the coming month are very bright.

There is a better demand for copper sheets and brass sheets and rods in the larger industries. Such concerns as the Eastman Kodak Company, the Bausch & Lomb optical works, and the signal works in Lincoln Park have been enjoying an increase in business since the heated term has passed. More men have been employed and an atmosphere of prosperity is again appearing. The demand for copper, brass, tin and aluminum is increasing in all of these concerns. The heavy building operations now going on in Rochester has stimulated the demand for tin, spelter and lead.

Reports from suburban points indicate a revival in business activities. The Lisk Manufacturing Company is planning to erect a $1,000,000 enameling plant in Geneva, which will be operated in connection with their large plants in Newark and Canandaigua. A new optical concern is about to locate in Geneva. This concern is from New Jersey. It employs gold, silver, brass wire, aluminum and glass in the making of its products.—G. B. E.

PROVIDENCE, R. I.

OCTOBER 2, 1922.

The Hartley Clock Company, which has been negotiating with a committee of the Attleboro Chamber of Commerce about a location in that city, has requested an extension of sixty days in which to complete the financing of the project. The Chamber of Commerce has agreed with the Clock Company that it would raise a sufficient fund to erect a building for the company, provided the company would raise a certain sum for equipment and working capital. The Chamber of Commerce has sufficient funds in sight to carry its part of the agreement but the Clock Company was unable, on account of general business conditions, to complete its financing within the specified time and therefore requested an extension of sixty days to enable it to secure these funds. The Clock Company in the meanwhile is having plans of the proposed building prepared so that no time will be lost in the erection of the structure, if the arrangements are carried through. The present indications are very favorable that the company will be successful in its efforts and that it will locate in Attleboro in the near future.

Fits All Wrench Company, of Providence, is the name of a corporation that has received a charter for the manufacture of wrenches of all kinds. The authorized capital is $5,000 and 450 shares of stock without par value. The incorporators are John C. Quinn, Peter W. McKiernan and John H. Di Stefanoo.

The Whiting & Davis Company, of Plainville, has had an immense sign erected near the Wrentham line with the greeting, "Welcome to Plainville, the Home of the Mesh Bag."

The Capitol Welding Company, Fred C. Hahn, manager, has opened its new plant, 246 Aborn street, where it has one of the largest, most thoroughly equipped and convenient welding plants in Providence, with the most up-to-date machinery for oxy-acetylene welding and cutting.

The F. A. Whiting Company, of Providence, capitalized at $60,000 for the purpose of manufacturing jewelry and novelties has received a charter. The incorporators are Mary B. Taft Whiting, Chester A. Salisbury and Ralph Rathbun.

W. R. Cobb Company, of Pawtucket, dealing in jewelers' findings and novelties, has obtained a charter. The authorized capital is 500 shares of non-par stock. The incorporators are Edgar E. Baker, George C. Whitshire and Frederick W. Hall.

Axel W. Bergman, of Cranston, and **William Bergman,** of Providence, are the promoters of the **Auburn Brass Foundry** to be located on Wellington avenue, Cranston. The firm is to engage in general manufacture of brass goods.—W. H. M.

NEWARK, N. J.

OCTOBER 2, 1922.

On a showing by Ralph E. Lum, of Lum, Tamblyn & Colyer, that a reorganization of the **Magna Metal Corporation** had been affected with from $110,000 of new capital, Vice Chancellor Backes has discharged the bill of complaint filed by William Harris pursuant to which a custodial receivership was established. The concern manufactures a metal claimed to be lighter and stronger than aluminum. It foundered through the alleged improvident handling of its affairs by its promoters, who paid a stock-selling agency approximately $400,000 for the floating of about $900,000 worth of stock. The order of dismissal signed by Vice Chancellor Backes gives John A. Bernhard $6,000 for his services as custodial receiver, a like amount to Mr. Harris, and $1,469 to Hyman Besser for services as accountant.

Under the scheme of reorganization, Mr. Lum explained, shareholders in the old corporation are to receive share for share in the new. The scheme, he told, has met with the approval of practically the entire body of old shareholders, many of whom, he said, have expressed a willingness to subscribe for additional shares in the reorganized concern.

The dismissal of the bill of complaint, the vice chancellor announced, carries with it the dismissal of a contempt proceeding brought by Mr. Harris against Oscar W. Nelson, who was treasurer of the old Magna organization. It was charged by Harris that Nelson made false answers concerning his bank account and his interest in the Federal Tool & Machine Manufacturing Co., represented in a Magna Company prospectus to have been acquired by it.

The process of lead plating instituted by the **Eagle Nickel Plating Company** in this city is a novel thing to the trade. Business demands have increased to such an extent that the company has moved to a new home at 23 Adams street. The company engages in processes embracing nickel, copper and lead plating, oxidizing, galvanizing, polishing and mechanical plating.—C. T. M.

TRENTON, N. J.

OCTOBER 2, 1922.

The John A. Roebling's Sons Company, Trenton, has placed into effect a pension and insurance system for the protection of all the employes who have been with the company for a year or longer. The insurance is graded according to length of service. All employes who have served more than one year and less than two will receive $500, increasing $100 each year until a maximum of $1,500 is reached. The pension plan will retire employes at the age of 60 for men and 55 for women. Pensions are also allowed in case of total disability arising from non-occupational injuries and illness, provided employes have served fifteen years or more. A minimum of $25 a month and maximum of $250 a month will be granted. The new system affects nearly 6,000 employes of the Trenton and Roebling, N. J., plants and offices and 200 employes in various branch offices throughout the country.

Oiltrol Piston Ring Company, of Camden, N. J., has been incorporated at Trenton with $100,000 capital to manufacture piston rings. The incorporators are F. R. Hansell, I. C. Clow and John A. MacPeak, of Camden.

The strike at the plant of the **Canister Manufacturing Company,** Phillipsburg, is expected to be settled soon. The company announces that it is not making a wage cut, but is working out a rearrangement of some of the rates to meet competition. The new plan is to put all employes on a piece work basis, which will tend to increase production and in turn increase wage earnings. In order to increase efficiency and production the company is installing new automatic equipment and experts will train the present employes the use of the same.

R. W. Darnell has resigned as vice-president, treasurer and general manager of the **Canister Manufacturing Company** of New Jersey and the **Republic Can and Metal Company** recently consolidated with the former plant. The new manager and treasurer is **R. E. Turl,** of New York. Mr. Darnell had been connected with the Canister Company for the past twenty-two years, first as chief clerk and later in an official capacity. In December, 1921, he was elected president of the Phillipsburg Board of Trade. He will shortly remove to California to engage in business for himself.

Application for a receiver for the **Sun Electric Lamp Company,** 129 Oliver street, Newark, has been made to Vice-Chancellor Foster by Ralph C. Dick, president of the concern. Lack of business and dissension among the officers have caused the company to cease operations, it is alleged. Assets are set at $5,436.87 and liabilities at $2,100. The corporation was organized in December, 1920.

Involuntary bankruptcy proceedings have been instituted by Abraham Henig for creditors of the **Tousek Engineering Company,** 228 Jeliff avenue, Newark, manufacturers of radio supplies. Judge Lynch appointed J. Frederick Israel as receiver.—C. A. L.

CLEVELAND, OHIO

OCTOBER 2, 1922.

The **Molders' Union** filed a $1,006,000 libel suit against the **American Plan Association** last week, claiming that it has defamed the molders by publication of July 19 of a circular letter sent to various manufacturing concerns in the city.

Fourteen men, the majority of them heads of large corporations were named as defendants individually and jointly.

The action was brought by Attorneys P. J. Mulligan and P. L. A. Lieghley, and signed by Fred Baumgartner, secretary of Local 218 of the Molders' Union, and authorized by a formal resolution of the union presented by Peter C. Hagan.

Three passages in the letter, which asked for contributions to an emergency fund to fight for the open shop, were objected to.

A blow was also struck last week by the companies—The Kilby Manufacturing Company; the Johnston and Jennings Company; the City Foundry Company, and the Cleveland Steel Casting Company, with the filing by the City Foundry Company of an amended petition for injunction against picketing and violence. Nine instances of alleged violence, five of which are said to have occurred since August 19, are cited in the petition. It is expected that this petition will have an important bearing when the case is tried, for a recent plea by the Kilby Company for injunction was refused by Judge Frederick P. Walther who said that no violence had occurred since the petition had been filed. His decision was handed down in the middle of August.

It was recently announced that **Fred W. Ramsey,** formerly president of the **Cleveland Metal Products Company** has accepted the position of chairman of the board of the **Cleveland Tractor Company.** This company is now making extensive plans for bringing out a light truck, which is expected to be ready for distributon this fall. The announcement that a light truck is to be manufactured by the Cleveland Tractor Company follows the discontinuing of plans for the manufacture of a passenger car, negotiations for which were under consideration for several months.

At a meeting in Cleveland, September 26, an attempt to settle the dispute between the Carpenters' Union and the Sheet Metal Workers' Union will be made, it was announced here this week. Who shall do the work of installing metal window and door trim in buildings is what they are disputing about.

It was announced that Cleveland had been chosen for the meeting, because the fight during the last few months has centered here.

Dr. George H. Madelung, designer of the successful Hanover glider which recently broke all previous records by staying aloft three hours in the competitions in the Rhone mountains, is now employed as project engineer at the **Glen L. Martin Company.** At the present time he is working on a motorless airplane which he hopes to make capable of reaching an altitude of 20.000 feet.—C. C. C.

BIRMINGHAM, ENGLAND

September 19, 1922.

Although business in the metal trades is still improving, but slowly the movement has been more decided during the last two or three weeks. Export requirements have been the chief factor in reducing unemployment. Home business is fluctuating and upon the whole shows very little likelihood of increase. This is especially the case with higher priced and luxury articles, as might be expected with the widespread unemployment and the falling incomes of the employing classes. The jewelry trade is still one of the least prosperous. A little spurt is being made with goods for Christmas, but the volume of such business is insignificant as compared with normal seasons and the bulk of it is in the cheaper lines. Silversmiths and electro-platers are doing a little better in the export trade. Some fair orders for table ware for passenger ships and hotels have been executed.

Metal rollers are better employed on brass and copper sheets. Demands for utility articles such as spoons and forks have improved to the advantage of firms producing white metals. Some progress is being made in the use of the new stainless nickel. One or two Birmingham firms have followed the example of Sheffield in this matter, but spoons and forks are almost the sole articles to which the metal has been applied. They are in request chiefly as substitutes for the unplated white metal and the cheaper electro-plated goods. The new metal is not absolutely unstainable, but is said to wear much longer and to require less cleaning than the materials hitherto in use.

The lamp trade has got a little busier with the approach of winter. Demands from the motor-car and motor-cycle industries have fallen off, but makers of hand lanterns and domestic lamps are showing some enterprise in preparing stocks and in the designing of novelties. Petrol vapor lamps with incandescent mantles are being pushed. Railway lamp requirements are not up to the average, and generally the amount of business coming to the metal trades from the railways is disappointing. Reductions in gas charges all over the country have stimulated the demand for gas heating and cooking stoves and generally benefited the gas-fittings manufacturers. Hollow-ware is in steadily growing request for export. The aluminium section which has been hard hit by German competition in the home market is now doing a little better. Under the Safeguarding of Industries' Act, German hollow-ware is now subject to an import duty of 33⅓ per cent.—G.

Business Items Verified

The **Metal Finishers' Supply Company, Inc.,** has been organized with its home office and warehouse at 491 Broome street, New York. It is operating three factories, and is in an excellent position to offer the trade not only its superior merchandise, but also its technical engineering service. Pierre Drewson is president and Edward S. Herberg is secretary and treasurer.

Radio enthusiasts having instruments tuned to the "WJZ" broad-casting station in Newark, N. J., can soon listen to a dissertation on the usefulness of zinc. W. Homer Hendricks, general sales engineer of the **New Jersey Zinc Company,** will deliver the zinc talk on Monday evening, October 23, at 8.30 o'clock.

A dividend of 2% on preferred stock has been declared by the **Black and Decker Manufacturing Company** for the third quarter of 1922. This makes a total of four dividends on Black and Decker preferred stock this year, totaling 8% with the likelihood of an additional dividend to be paid at the end of the year. The Black and Decker Manufacturing Company state that a tremendous increase in sales due to a considerable extent to their reduction in prices made the first of the year has enabled them to get on a production basis.

A rumor had it that the **Anaconda-American Brass Company,** New Toronto, Ont., intended to erect a new foundry, but their latest advices state that they have contemplated no additions to their Canadian plant.

The **F. S. Pearson Engineering Corporation,** Fisk Building at 57th street and Broadway, New York City, has reestablished its department for industrial management and technical auditing of industries and public utilities. This department will be carried on together with the usual work of financing, developing, design and construction of engineering projects and industrial plants.

What is said to be the first statue cast in aluminum is a bust of the late **Charles M. Hall,** the scientist credited with the application of the electrolytic process to the refining of aluminum which has brought the metal into its numerous commercial uses. It was cast in New York by **Giuseppe Moretti,** a sculptor of 4029 Bigelow boulevard, Pittsburgh, Pa. The size is 5 ft. 9 inches, and it is cast in an aluminum alloy having the finished appearance of old silver, which brings out very beautifully the lights and shadows.

The **Bridgeport Brass Company,** Bridgeport, Conn., announce the opening of a Detroit office in the General Motors Building, Detroit, with Mr. Frank H. Longyear as district manager.

The **Bridgeport Bronze Company,** Bridgeport, Conn., has filed papers of incorporation, with a capital stock of $200,000. The incorporators are Jonathan Groat, Howard L. Schaff and Hilda M. Trainor.

The **Hayes Brass Foundry,** Syracuse, N. Y., has been incorporated with 500 shares of common stock, no par value. The active capital is $5,000. The incorporators are C. H. Hayes, V. Adler, J. Whitbread.

The **New Jersey Valve & Fitting Company, Inc.,** Hawthorne, N. J., has been organized by James C. Smith and James A. Duffy, both formerly with McNab & Harlin. The company is capitalized at $100,000. It has a capacity of 12 tons a week of castings which includes both the foundry and machine shop for finishing.

In the plant of the **Waterbury Manufacturing Company,** Waterbury, Conn., 34,000 or more articles have been made from brass. These articles range in size from the smallest machine screw to large vacuum bottles, some of the articles having as many as 40 or 50 different parts, and the amount of detail and trouble that can be caused by one small item is surprising to one unused to the petty details and chances of irritating mistakes in the manufacturing business.

Approximately 100,000,000 lbs. of copper will be utilized this year in the manufacture of automobiles in the United States, according to a survey just completed by the **Copper and Brass Research Association.** This is an increase of 30,000,000 lbs. over 1921, and is about 750,000 lbs. more than for 1920, in which year the automobile industry consumed 7.63 per cent of the total copper production.

Phœnix Brass Foundry, Irvington, N. J., has just completed the erection of a large, modern brass foundry, equipped for making castings in bronze, brass and aluminum, in any size or quantity.

U. S. Electro Galvanizing Company, 32 Stockton street, Brooklyn, N. Y., announces a change of name to **U. S. Galvanizing and Plating Equipment Corporation.**

The application for a receivership brought against the **Magna Metal Corporation,** Newark, N. J., by certain stockholders was dismissed September 20th by Vice-Chancellor Backes, and reorganization of the concern is to be undertaken at once. It was stated that between $100,000 and $110,000 would be raised by stockholders within sixty days and the concern would soon resume business.

An advance of 5 cents an hour in the wage of so-called competent common labor, already in effect, was announced by the **Chase Metal Companies,** Waterbury, Conn., the **Chase Rolling Mills,** Waterbury, Conn., the **Scovill Manufacturing Company,** Waterbury, Conn., and the **American Brass Company,** Waterbury, Conn. In the last named instance the advance also applies to the plants of the company in Torrington and Ansonia. Under the new scale common labor will receive 35 cents an hour.

The National Lead Company, 111 Broadway, New York, has acquired an interest in the Compania Estaniferam, said to be the largest producer of tin in the world. The purchase of the shares, it is understood, was aided in part by the decline in the Chilian peso to less than 10 cents, while the shares of the company at the same time were quoted at less than normal on the Valparaiso Exchange. The holdings of the National Lead Company, together with those of Simon Patino, a tin mine owner in Bolivia, represent control of the company.

The Richmond Pressed Metal Works, Inc., 601 Stockton street, Richmond, Va., has awarded contract to the F. H. Boatwright Company, Richmond, for a new one-story plant, 110 x 160 ft., to cost about $30,000. The installation will include shears, punch presses, plating equipment, etc. The company recently increased its capital to $150,000 for expansion.

The Adelphia Manufacturing & Plating Company, Bridesburg, Philadelphia, Pa., manufacturer and plater of iron, brass, steel and metal products, has been incorporated with a capital of $20,000, and will continue the business of the Adelphia Plating Company, established in 1917. It is in the market for complete foundry equipment. A brass foundry is being added and the company will specialize in aluminum castings. It is also erecting a new one-story building at Orthodox and Belgrade streets which will be permanent headquarters. J. F. O'Brien, 4514 Paul street, is secretary and treasurer.

A merger of the **M. S. Little Manufacturing Company,** 151 New Park avenue, Hartford, Conn., and the **A. J. Beaton Manufacturing Company,** of New Britain, involving nearly $500,000, will be completed within a few weeks. The new corporation will be known as the M. S. Little Manufacturing Company. New officers are: M. S. Little, president; W. E. Frohock, treasurer; M. R. Koerner, secretary; H. B. Carey, vice-president.

The J. B. Ford Company, Wyandotte, Mich., will exhibit the Wyandotte Metal Cleaner at the International Steel Exposition, October 2 to 7. A model cleaning tank will be in operation showing practical tank construction and the advantages of the use of Wyandotte Metal Cleaner in modern production practice.

Acme Works, Inc., 420 S. Harding street, Indianapolis, Ind., manufacturer of castings, etc., will commence the immediate erection of a one-story addition, 50 x 150 ft., to be used as a metal and wood pattern shop and other service. Peter Lambertous is president.

By mutual consent, the co-partnership consisting of **Benjamin F. Klein,** and **Wm. J. Schoenberger,** trading as **United Brass Manufacturing Company,** located at 3844 Hamilton avenue, Cleveland, Ohio, has been dissolved, effective September 1, 1922. The United Brass Manufacturing Company continues as heretofore in the manufacture of plumbing brass goods and water works brass goods at its present location, under the sole ownership of Mr. Benjamin F. Klein. Mr. Wm. J. Schoenberger withdraws, and takes over the Gas Valve & Stove Cock Department which will be operated by the W. J. Schoenberger Company, located at Havard avenue at 103rd street, Cleveland, manufacturing brass gas valves, gas cocks and special fittings for gas appliances.

The Walworth Realty Company, a subsidiary of the Walworth Manufacturing Company of Boston, manufacturer of the Stillson wrench, the Walmanco joint and other steam and gas fittings, tubes, etc., has awarded to Dwight P. Robinson & Company, Inc., 125 E. 46th street, New York, the contract for the design and construction of a warehouse, pipe shop and garage to be located on Jackson avenue, Long Island City.

The exhibit of **The Pangborn Corporation,** Hagerstown, Md., will be complete with a cabinet sand-blast in operation, and also photographs of installations of various types of sand-blast equipment in the steel treating industry. Specimens of various grades of angular steel grit and samson steel shot; the dustless sand-blast abrasives, will be be shown in actual use in equipment demonstrating wearing qualities and finishes produced.

Stephen & Wolff, Inc., Buchanan and Loomis streets, Rockford, Ill., has recently been incorporated with $25,000 capital stock. They are taking over the former business of Stephen & Wolff. A small foundry at the above address is being leased for the manufacture of dental flasks, articulators, bolts for dental flasks, and a line of bronze, brass, aluminum and white metal castings. The company is in the market for an engine lathe, several milling machines, and turret lathes.

The Guyan Machine Shops, Logan, W. Va., are in the market for a slitting shear and punch, to handle ½-inch plate.

The J. & S. Plating Company, 112 East Washington street, Jackson, Mich., was recently organized, and will operate a plant for the manufacture of plated metal products, principally in the automobile line.

The International Lead Refining Company, McCook avenue, East Chicago, Ind., will soon commence the erection of a one-story addition, 50 x 100 ft. The estimated cost is about $30,000.

MANUFACTURE AND USES OF ALUMINUM

An investigation of the commercial methods of manufacture, together with the properties and uses of light aluminum alloys, has been undertaken by the Bureau of Mines for the purpose of making available a compendium of the existing information. The compiled data are to be published in the form of a Bureau of Mines bulletin. The report covers the commercial production of aluminum-alloy sand castings, die castings, and permanent mold castings, and worked manufactures; foundery practice; the properties and uses of aluminum alloys; and a discussion of the principal aluminum-alloy systems, e. g., aluminum-copper, aluminum-iron, aluminum-magnesium, aluminum-manganese, and aluminum-zinc systems, as well as the principal ternary systems. Patented alloys are dealt with at some length, and the preparation of various alloys taken up.

New Tariff Schedule

The following is the tariff schedule as passed by Congress, compared with the Underwood Law, formerly in force. Most of the items of interest to the metal and plating trades are given.

SCHEDULE 1.

	McCumber-Fordney	Underwood
Boric Acid (lb.)	1½c.	¾c.
Alcohol—		
Amyl, Butyl, Propl (lb.)	6c.	¼c.
Fusel Oil (lb.)	6c.	¼c.
Methyl (wood) (gal.)	12c.	Free
Potash Alum (lb.)	¾c.	15%
Ammonium Chloride (lb.)	1¼c.	¾c.
Ammonium Sulphate (lb.)	¼c.	Free
Argols (under 90 %) (%)	5	5
" (over 90%) (lb.)	5c.	2½c.
Cobalt Salts and Cpds. (%)	30	15
Acetates of Lead—		
White (lb.)	2½c.	1¼c.
Brown, Gray, Yellow (lb.)	2c.	1c.
Other Lead, Cpds. (%)	25	20
Phosphorus (lb.)	8c.	Free
Chromium Colors (%)	30	20
Potassium Carbonate (lb.)	¾c.	Free
Potassium Hydroxide (lb.)	1c.	Free
Sodium Carbonate (lb.)	¼c.	Free
Sodium Hydroxide (lb.)	½c.	¼c.
Sodium Nitrate (lb.)	3c.	½c.
Sodium Phosphate (lb.)	½c.	¼c.
Sodium Silicate (lb.)	⅜c.	Free
Sodium Hydrosulphite (%)	35	15
Tin Salts (%)	25	10
Zinc Sulphate (lb.)	¾c.	½c.

SCHEDULE 3. METALS AND MANUFACTURES OF METALS.

	McCumber-Fordney	Underwood
Cerium Metal (lb.)	$2.00	30%
Cerium Alloys (lb.)	$2+25%	15%
Alum. Household Ware (lb.)	11c.+55%	25%
Copper and Brass—		
Household Ware (%)	40	20
Metal Buckles (Per 100)	5–15c.+20%	15%
Metal Hooks and Eyes (lb.)	4½c.+25%	25%
Metal Trouser Buttons (grs.)	1/12c.	15%
Aluminum, Crude (lb.)	5c.	2c.
Aluminum, Plates, Bars, etc. (lb.)	9c.	3½c.
Magnesium, Metallic (lb.)	40c.	25%
Magnesium Alloys (lb.)	40c.+20%	25%
Antimony Metal (lb.)	2c.	10%
Bismuth (%)	7½c.	Free
Cadmium (lb.)	15c.	Free
Liquated Antimony (lb.)	¼c.	Free
German Silver, unmanufactured (%)	20	15
Nickel Silver, sheets, etc. (%)	30	15
Copper Rolls (lb.)	2½c.	5%
Copper, Engrs. Plts., not grd. (lb.)	7c.	5%
Ground (lb.)	11c.	5%
Brass Rods, etc. (lb.)	4c.	20%
Seamless Brass Tubing (lb.)	8c.	20%
Brazed Brass Tubes (lb.)	12c.	20%
Bronze Rods and Sheets (lb.)	4c.	20%
Bronze Tubes (lb.)	14c.	25%
Bronze Powder (lb.)	14c.	25%
Bronze Leafs (per 100)	6c.	25%
Gold Leaf (per 100)	55c.	35%
Silver Leaf (per 100)	5c.	30%
Tinsel Wire (lb.)	6c.+10%	6%
Tinsel Bullions (lb.)	6c.+35%	25%
Tinsel Ribbons (%)	45	40
Tinsel Fabrics (%)	55	40
Quicksilver (lb.)	25c.	10%
New Types (%)	20	15
Nickel in Pigs (lb.)	3c.	10%
Nickel Bars and Sheets (%)	25	20
Lead Bearing Ores (lb.)	1½c.	¾c.
Lead Bullion and Pigs (lb.)	2⅛c.	25%
Lead in Sheets (lb.)	2⅜c.	25%
Zinc-bearing Ore—		
Under 10% Zinc	Free	10%
10@20% Zinc	½c.	10%
20@25% Zinc (lb.)	1c.	10%
Over 25% Zinc (lb.)	1½c.	10%
Zinc in Pigs (lb.)	1¾c.	15%
Zinc in Sheets (lb.)	2c.	15%
Zinc in Plated Sheets (lb.)	2¼c.	15%
Old Zinc (lb.)	1½c.	15%
Print Rollers and Blocks (%)	60	20@50%
Other Metal Articles or Ware (%)	40	20@50%

SCHEDULE 2.

	McCumber-Fordney	Underwood
Magnesite Brick (lb.)	¾c.+10%	10%
Chrome Brick, unglazed (%)	25	10
All other brick (%)	25	10
Pumice Stone, Mfrd. (cwt.)	55c.	¼c. lb.
Pumice Stone Products (%)	35	25
Fluorspar (ton)	$5.60	$1.50
Graphite, amorphous (%)	10	Free
Graphite, Lump (%)	20	Free
Graphite, Flake (lb.)	1½c.	Free

SCHEDULE 14. SUNDRIES.

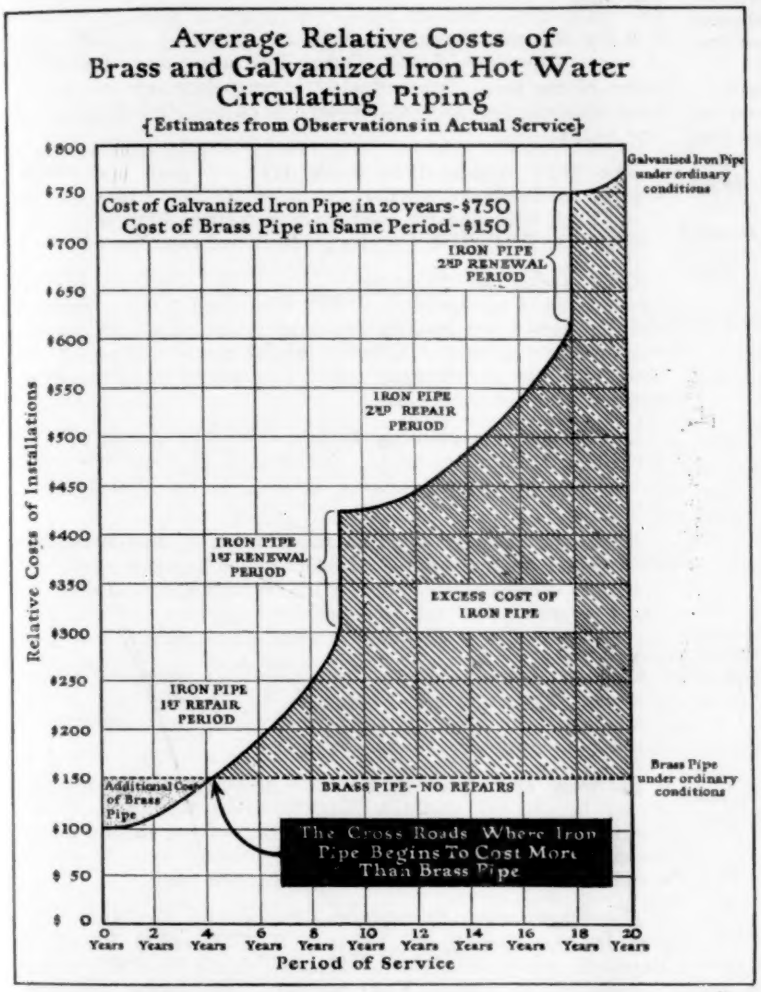
	McCumber-Fordney	Underwood
Jewelry above 20c. per doz. pieces in value (%)	80	60
Ropes, chains, etc., not excepting rail-inch in diameter, valued above 30c. yard, smokers' articles, mesh bags, vanity cases, etc. (%)	80	60
Stampings, galleries and other materials of metal for manufacture above articles (%)	75	50

FREE LIST.

	McCumber-Fordney	Underwood
Hydrofluoric Acid	Free	Free
Hydrofluoric Acid or Muriatic	"	"
Nitric Acid	"	"
Sulphuric Acid	"	"
Bells and Bell Metal to be remanufactured	"	"
Borax, unmanufactured, borate of lime, borate soda	"	"
Brass and Dutch Metal for remanufacture	"	"
Bullion, gold or silver	"	"
Calcium: Acetate, chloride (crude), nitrate, lime nitrogen	"	"
Linotypes, typesetting machines, typewriters, shoe machinery, sand blast machines, oil-spreading machines	"	"
Composition Metal, copper chief component material	"	"
Copper ore, copper cement, old copper for manufacture, bars, ingots, etc., not manufactured	"	"
Copper sulphate, copper acetate and sub-acetate	"	"
Metallic mineral substances, crude and metals unwrought, not specifically provided for	"	10% ad.v.
Barium, calcium, sodium and potassium and alloys of which said metals are chief component	"	25% ad.v.
Cuttlefish Bone	"	Free
Ferrous Sulphate	"	"
rhodium, and ruthenium and any combination thereof with platinum	"	"
Ores of gold, silver or nickel, nickel matts, ore of the platinum		

metals, sweepings of gold and Silver	Free	Free
Platinum, unmanufactured or in ingots, bars, sheets or plates not less than ⅛-inch in thickness, sponge or scrap	"	"
Potassium Chloride, Potassium Sulphate, Kainite, Wood Ashes, Beet Root Ashes, and all crude Potash Salts, not specifically provided for	Free	Free
Cyanide	"	"
Sulphur in any form, sulphur ore containing 25% sulphur	"	"
Tin ore and black oxide of tin	"	"
Tin in bars, block or pigs and grain or granulated and in scrap tin	"	"

Brass Is Cheaper Because You Pay for It Only Once



In point of cost, perhaps the least expensive important unit in any building is the pipe in the plumbing system. In residence buildings, for instance, pipe represents only about one-tenth of the cost of a plumbing installation, and the plumbing in turn is about six per cent of the entire cost of the house.

When short-lived, quick-rusting piping is used, however, this inexpensive yet vastly important item becomes a prolific source of expense and trouble.

Improvements in the technique of plumbing and the quality and appearance of the fixtures used have been very marked in the past several decades, but plumbing pipe continues to be the least effective unit in modern sanitation.

It is, however, freely predicted by those closest to the plumbing industry, that the most noticeable improvement in plumbing in the near future will be in the direction of the use of more durable and hence more economical materials in that mare's nest of trouble and expense, water circulating piping.

Brass is so well known as an enduring and satisfactory metal for plumbing pipe that it would be universally used, except for the fact that some people believe it is expensive because it costs a little more—about $75 more than quick-rusting iron pipe in a $15,000 house, for instance.

"Red" water from rusted iron piping is vexing enough; so are rust-blemished plumbing fixtures; and a dwindling flow of water isn't particularly pleasant. But the dollars and cents of the matter is naturally the primary concern of the people who pay the bills for the nation's building.

Of course there can be nothing absolute about comparisons of cost between brass and galvanized iron pipe. Experience of individuals and localities differs. In order, however, to obtain information covering as wide a field as possible on this subject, a prominent sanitary engineer of many years' experience with all classes of building construction was asked recently to give the public the benefit of his experience with regard to the relative cost of brass and galvanized iron plumbing pipe over a period of years. His experience is set forth in graphic form. The facts speak for themselves—and speak very forcibly on that phase of the subject which of necessity means most to everybody—that is, the marked saving which always follows the use of brass.—Bulletin of the Copper & Brass Research Association.

FRAUDULENT METAL BADGES

The Attorney General of the United States has called the attention of the Metal Trades to the fact that throughout the country today there are many instances in which manufacturers of metal badges, worn usually by officers of the law, have made or sold to unauthorized individuals metal badges purporting to be official insignia of Government officers. As a result of the promiscuous sale of such badges, many individuals have been arrested, charged with the false impersonation of Federal officers.

It can easily be seen where a manufacturer of badges may be subjected to liability, or at least to embarrassment, because of the manufacture and sale of badges to unauthorized officers. Instances arise in which the manufacturer easily can be considered a party to the offense.

A safe rule, and an easy one to follow, is to assure oneself that any person purchasing or ordering a badge of any Federal officer, particularly agents of the Department of Justice, United States marshals, and Prohibition enforcement officers, are duly authorized officials. In every instance in which an officer is entitled to a badge, such a badge is issued to him without cost, by his department, and the very fact that an individual orders or purchases a Federal officer's badge is a true indication of irregularity.

You will be rendering a distinctly patriotic service in assisting the Government in enforcing the law, if you will report immediately, either to the local agent of the United States Department of Justice, or wire that department at Washington—or in emergency cases call the attention of the local police to any instance of this kind.

ZINC USES

In the past few months a considerable quantity of sheet zinc was used for making flumes, used in small reclamation projects. They proved satisfactory and as a result the Government some time ago placed orders for zinc flumes to be used in five large United States reclamation projects in western states.

Zinc organ pipes have been in service for several years, but it is only in the last few months that this business has developed into fair proportions. One of the leading local musical instrument makers bought a considerable amount for organ pipes re-

cently and probably zinc will be used in the manufacture of other musical instruments.—Joplin (Mo.) Globe, September 13, 1922.

COPPER COMPANY SEVEN CENTURIES OLD

On the letterheads of the Great Copper Mountain Mining Company, Inc., of Sweden, one reads this astounding legend: "Founded in 1225."

Mining and smelting were carried on near Falun, Sweden, 700 years ago and prospered to the extent that in the 17th century Sweden led all countries in copper production. (True, the entire world's consumption for the year 1655 was only 3,453 tons, the output of the Swedish mines, today controlled by the above-named company.) A charter dated 1347 specifies certain privileges that the miners were to enjoy.

"But the company's records go back farther," according to a recent article in the "Swedish-American Trade Journal" and reprinted in "The Yellow Strand." "A letter dated 1288 shows that a certain Bishop Peder acquired a one-eighth share of the Falun mine by trade." Mining of the ore, smelting, and manufacturing copper products were conducted separately. Until 1716 mining was done by individuals exercising their rights as "par" (share) holders. The ore was also smelted privately in picturesque little huts, this practice continuing until 1862. The company took over the manufacturing end as early as 1641.

The Falun Copper Mine has yielded 35 to 40 million tons of ore, from which has been extracted 500,000 tons of copper.

COMPULSORY ARBITRATION

Compulsory arbitration of strikes which affect the welfare of all the people of the country, such as the railroad and coal strikes, was advocated by Chauncey M. Depew, former United States Senator and chairman of the Board of Directors of the New York Central Railroad Company, in a speech at Briarcliff Lodge, New York.

"There is something radically wrong in our constitution and make-up," he continued, "unless we find some means of keeping one small part of our population from taking the rest by the throat. A few million employees of the railroads under improper leadership could stop them. In a short time that would produce death. There isn't a city but would be starving in a week."

Mr. Depew suggested that some form of compulsory arbitration was necessary.

"There should be an understanding," he added, "that this is not a government of blocs, but of all the men, women and children of the United States."

CIVIL SERVICE EXAMINATIONS

The United States Civil Service Commission announces open competitive examinations for junior engineer, junior physicist, and junior technologist on November 22, 1922. Vacancies in the Bureau of Standards, Department of Commerce, for duty in Washington, D. C., or elsewhere, at $1,200 to $1,500 a year, and in positions requiring similar qualifications, at these or higher or lower salaries, will be filled from these examinations, unless it is found in the interest of the service to fill any vacancies by reinstatement, transfer, or promotion.

Applicants should at once apply for Form 1312, stating the title of the examination desired, to the Civil Service Commission, Washington, D. C., or to the Secretary of the United States Civil Service Board. Applications should be properly executed, excluding the medical certificate, and must be filed with the Commission at Washington in time to arrange for the examination of the applicant.

TRADE PUBLICATIONS

Economic Electric Power Transmission.—A most attractive catalogue issued by the British Aluminum Company, Ltd., 165 Broadway, New York, showing the application of aluminum to electric power transmission. Numerous charts, tables and illustrations are included.

Zapon Lacquers and Lacquer Enamels.—A booklet issued by Celluloid Zapon Company, 200 Fifth avenue, New York, illustrating and describing the Master Finishes for beautifying and protecting all metal surfaces.

Wolffgram Seamless Copper and Brass Tube Rolling Mills.—A booklet issued by L. Wolffgram, Erie, Penna., illustrating and describing their rolling mill equipments, foundry equipment, furnace equipments and drawing equipments.

Relays—Operation and General Application.—Bulletin 47,-606, issued by the General Electric Company, Schenectady, N. Y., describing relays and their operation and general application.

Baily Electric Furnaces.—A folder issued by The Electric Furnace Company, Salem, Ohio, illustrating and describing some of the many types of electric enameling, annealing and heat treating furnaces which have been installed in the last few years.

The Trow Alcolm Blue Book, 1922.—A desk manual designed to meet the buying needs of 300,000 executives in New York City and the surrounding metropolitan area. Issued by R. L. Polk & Co., Inc., 524 Broadway, New York.

Ohio Industrial Directory.—Issued by Buckeye Listing Co., 208 St. Clair avenue, N. W., Cleveland, Ohio. Sensing the real need for a practical work of this kind, the publishers have tried to make this directory of the metal working industries of Ohio as complete and comprehensive as possible, without being cumbersome.

DeVilbiss Spray-Painting System.—A folder issued by The DeVilbiss Manufacturing Co., Toledo, Ohio, illustrating and describing their spray-painting system, its uses, advantages, etc.

Automatic Safety Guards for Tolhurst Self-Balancing Centrifugal Extractors.—A folder issued by the Tolhurst Machine Works, Troy, New York, illustrating and describing a guard device recently perfected by the Tolhurst Machine Works for application to their Extractors.

Cadman Metals.—An engineering bulletin, issued by A. W. Cadman Manufacturing Company, Pittsburgh, Pa. It includes a considerable amount of information on babbitts and bearing metals made by said company.

Bearings and Bearing Metals.—An engineering bulletin issued by A. W. Cadman Manufacturing Company, Pittsburgh, Pa. This bulletin specializes on bearing metals alone, giving much interesting and valuable information. It covers metals with tin base, lead base and copper base.

The Engineering Foundation.—Publication No. 4 on Report for the Year Ended February 9, 1922, and a Report of Research on the Fatigue of Metals, issued by Engineering Foundation of United Eng. Society, Engineering Societies Building, New York.

Lionite.—A folder issued by the General Abrasive Company, Inc., Niagara Falls, N. Y., illustrating and describing Lionite, an abrasive.

Northern Cranes and Hoists.—A booklet issued by Northern Engineering Works, 210 Chene street, Detroit, Mich., illustrating their electric traveling cranes, gantries, etc.

Zellac.—A leaflet issued by Zeller Lacquer Manufacturing Company, 342 Madison avenue, New York, describing their new trade-mark.

Bristol's Pyrometers.—Catalogue No. 1401 issued by The Bristol Company, Waterbury, Conn., illustrating and describing their low resistance pyrometer and high resistance pyrometer.

Syracuse Universal Blower.—Bulletin No. 5 and 6, issued by Syracuse Industrial Gas Company, 208 S. Geddes street, Syracuse, N. Y., illustrating and describing their fan type blower.

Ledrite.—A folder on chamfered brass rod made by the Bridgeport Brass Company, Bridgeport, Conn.

Plumrite.—A folder on brass pipe made by the Bridgeport Brass Company, Bridgeport, Conn.

Wentworth Institute of Boston, Mass.—Catalogue for 1922-1923 giving complete information about this school where boys and young men with natural abilities in mechanical, technical or industrial art work may prepare themselves for positions of superior grade, with future promise in the trade and industries.

Galvanizing and Plating Equipment.—Bulletins issued by U. S. Galvanizing and Plating Equipment Corp., Brooklyn, N. Y. (formerly U. S. Electro Galvanizing Co.). These bulletins describe and illustrate the U. S. moving cathode plating apparatus and the U. S. automatic cleaning, pickling, acid dip, neutralizing, rinsing, drying and allied equipment.

The Thomas Register, published by the Thomas Publishing Company, 461 Eighth Avenue, New York. Price, $15.00, payable in advance. For sale by The Metal Industry.

This is the 1922 edition of the well-known buyers' index. The book is considered a standard of its kind and is found in practically every place where business is done. The publishers state that the new edition includes 150,000 changes and that for this reason it is necessary to replace the old edition; also that more than 98 per cent of this edition are sold and that moreover this is the only work of its kind which has as much as 50 per cent paid circulation.

Wave Transmission, by Walter Haddon, 132 Salisbury Sq., Fleet St., London, England.

This is a pamphlet describing what is called a new and original scientific discovery or a sixth method of transmitting power. The author states that wave transmission is applicable to most industrial purposes. It combines many practical advantages with high efficiency and great economy in the distribution and application of power.

The invention covers not only the principle of wave transmission but its application as applied to transmitting energy by means of impulses through water. In addition, numerous machines and accessories, such as flexible pipe line, rotary motors, rock drills, etc., are included.

Metal Market Review

Written for The Metal Industry by METAL MAN

COPPER

Business in copper during the past month was on a fairly active scale. Demand from the brass industry was very good and deliveries to the home trade were moving in large volume. Total sales in September are estimated at 125,000,000 pounds, about 50 per cent. of which is set down to export orders. Aggregate sales by American producers for the last three months are estimated at 350,000,000 to 375,000,000 pounds.

Total sales of copper for the first nine months of this year are estimated at 1,180,000,000 pounds. There has consequently been a very substantial reduction in surplus stocks since January 1. Recent deliveries into domestic consumption and for foreign shipment are at the rate of about 160,000,000 pounds a month. With refinery output estimated at 130,000,000, there is an indicated reduction in surplus stocks of about 30,000,000 pounds a month. Stocks of refined copper on October 1 are estimated at some 270,000,000 pounds. The market remains steady on the basis of 14c for electrolytic; 14⅛ @ 14¼c for lake brands and 13⅜ @ 13½c for casting. The amount of copper that will go into building and construction work this year in the shape of brass, bronze and other forms is estimated by authorities in the trade at 150,000,000 pounds, or 100,000,000 pounds more than in 1921.

ZINC

The strength and activity of the zinc market have been outstanding features for many weeks. Prime western for October shipment is now 7.20c. New York and 6.85c at East St. Louis, an advance in the last 30 days of more than half a cent per pound. The advance in price since April 1 is 2.20c per pound. Demand from consuming interests was in large volume during September, although less activity is reported within the last few days. Smelter output was somewhat smaller in August, being 31,423 tons, against 31,917 tons in July. Stocks were drawn down to 21,629 tons on August 31, 1922, showing a decrease of 6,989 tons. The decrease in domestic stocks in smelters' hands for the first eight months of 1922 amounted to 44,049 tons. Present stocks are the lowest in over two years. Market tone is more subdued recently and buying is confined to moderate dimensions. Prices are unchanged, however, and buyers and sellers recognize the strong statistical position of the market.

TIN

There have been several moves to advance tin in the domestic market lately, but American buying interest has been cautious in following the bullish tendency of the London market. However, a better inquiry developed here lately and a fair movement resulted. Offerings from London reflect the confidence prominent holders entertain regarding the entire tin situation. English operators regard the position of this metal as particularly sound, and with labor and fuel conditions in more favorable shape greater activity is expected during the balance of the year. The New York market is steady and quiet at 32¾c @ 33¼c for Straits. Banca is scarce and quotes 32¾c and 99 per cent. at 32⅛c. American deliveries of foreign tin during September were 5,050 tons, as compared with 4,150 tons in August. The stocks of tin October 1 amount to 1,236 tons being a decrease of 1,564 tons. United States deliveries last month are nearly double what they were September, 1921.

LEAD

New high levels in selling price has emphasized the stringency of available supplies and the persistent demand for lead in all markets. There continued to be a most active consuming demand for lead during the past month. Within the last thirty days the New York price has advanced from 5.90c to 6.50c on actual business, with East St. Louis position quoting 6.35c.

The American Smelting & Refining Co. on October 6 announced an advance in their price of pig lead to 6.50c New York, and 6.30c E. St. Louis. The outside market is quoting nominally 6.65c to 6.75c. Spot supplies are small, with buyers inclined to feel uneasy over the outlook.

ALUMINUM

Market prices of aluminum have been advanced 1c to 2 c per pound in all quarters of the trade within the last few days. A peculiar feature of the situation is the way quotations for the domestic product have been guarded since the new tariff went into effect. There appears to be a strong aversion to publicity for some reason, and sellers of the American article are understood to have withdrawn prices quoted formerly and to be open for orders on the basis of private negotiation only. The outside market for imported aluminum is quoted at around 20c to 21c for 98-99% virgin metal. The advance in the duty on ingot aluminum is from 2c per lb. to 5c per lb., and on sheets and coils from 3½c per lb. to 9c per lb.

ANTIMONY

Chinese 99 per cent. antimony has advanced to 6¾c to 6⅞c duty paid in carload quantities, which compares with 5⅜c 30 days ago. At the beginning of this year the market was on the New York basis of 4.45c. There has been a moderate demand in recent weeks, but at this writing the market is not characterized by any special activity. Output in China is much below the usual quantity produced as prices are not attractive enough to mine owners to operate properties on a large scale. The consuming demand has quieted down lately and the market is steady and stationary at 6¾c @ 7c for carload lots of Chinese regulars.

QUICKSILVER

Quicksilver is another article of commerce which has had a pronounced advance in recent weeks. Holders are now quoting $71 @ $73 per flask. The market was active at considerably lower prices before the new tariff became effective. Larger supplies are expected from California within the next few months. Producing properties in that state are now active, and shipments from those sources are looked forward to in future months. Several important foreign shipments have arrived here lately. Prices are firm, but demand is less urgent than a few weeks ago.

PLATINUM

Since our September number the domestic price of platinum has advanced to $118 per ounce. This price compares with $108 about a month ago.

This market has suffered a sudden drop of $6 an ounce. On October 6 the New York quotation was $112 an ounce, against $118 a few days previous. The stringency of the situation was relieved by freer offerings of scrap. Supplies, however, are limited and anything is likely to happen in the near future.

SILVER

The silver bullion market has been quiet lately, but the narrow range of prices for product of foreign origin indicates decided stability prevailing. Buying for China and India has been quiet for several weeks, and there is no special speculative demand to note. Pittman silver purchases to date by U. S. Government amount to somewhat over 132,000,000 ounces at the fixed price of 99¼ to 99⅝ cents per ounce. Silver imports for the first eight months of 1922 were $46,793,050, against $39,816,491 in 1921. Silver exports for same period amounted to $42,291,006, against $29,897,750 in 1921. Quotations for bar silver October 3 are 99¼c for domestic origin, 69⅜c for foreign origin and 35 7/16d at London.

OLD METALS

New inquiries for the scrap metals have been running strong lately. Available supplies at all points are consequently finding ready sale at firm prices. Demand has been especially brisk for scrap copper. It is a sellers' market, and buyers appear to realize the situation and have readily paid going prices for the material desired. Inquiries continue along substantial lines for scrap lead and zinc and the more popular grades of crucible and heavy copper. The market for scrap metals is surprisingly firm arising from widespread business improvement and the excellent demand for this class of old material. We quote following prices which dealers were prepared to pay: Crucible copper 12c @ 12¼c; light copper 9¾c @ 10¼c; heavy brass 6½c @ 6⅞c; new brass clippings 8½c @ 8¾c; aluminum clippings 13c @ 14c; composition scrap 8½c @ 8⅞c; heavy lead 5⅜c @ 5⅝c; new zinc scrap 4⅝c @ 4⅞c, and old zinc scrap 3½c @ 3⅞c.

METAL STOCK MARKET QUOTATIONS

	Par	Bid	Asked
Aluminum Company of America	$100	$420	$460
American Hardware Corp.	100	192	195
Bristol Brass	25	...	21
International Nickel, com.	25	16½	18
International Nickel, pfd.	100	81	82½
International Silver, com.	100	25	...
International Silver, pfd.	100	101	103
New Jersey Zinc	100	154	156
Rome Brass & Copper	100	105	115
Scovill Mfg. Co.	100	330	330
Yale & Towne Mfg. Co.	...	315	325

Corrected by J. K. Rice, Jr., & Co., 36 Wall Street, New York.

WATERBURY AVERAGE

Lake Copper—Average for 1920, 13.136. January, 1922, 13.875—February, 13.375—March, 13.125—April, 13.00—May, 13.375—June, 14.00—July, 14.125—August, 14.125—September, 14.25.

Brass Mill Zinc—Average for 1920, 5.175—January, 1922, 5.25—February, 5.00—March, 5.10—April, 5.40—May, 5.55—June, 5.85—July, 6.20—August, 6.50—September, 7.10.

Daily Metal Prices for the Month of September and October 6, 1922

Date	1	4	5	6	7	8	11	12	13	14	15	18	19
Copper (f. o. b., Ref.) c/lb.:		Holiday											
Lake (Delivered)	14.00	....	14.00	14.00	14.125	14.125	14.125	14.125	14.25	14.25	14.25	14.25	14.25
Electrolytic	13.875	....	13.875	13.875	13.875	13.875	13.875	13.875	13.875	13.875	13.875	13.875	13.875
Casting	13.375	....	13.375	13.375	13.375	13.40	13.40	13.40	13.40	13.40	13.40	13.40	13.40
Zinc (f. o. b. St. L.) c/lb.:													
Prime Western	6.25	....	6.25	6.25	6.25	6.30	6.35	6.40	6.45	6.45	6.50	6.60	6.70
Brass Special	6.35	....	6.35	6.35	6.35	6.40	6.45	6.50	6.55	6.55	6.60	6.70	6.80
Tin (f. o. b. N. Y.) c/lb.:													
Straits	32.70	....	32.375	32.50	32.50	32.375	32.25	32.20	32.25	32.25	32.20	32.125	32.125
Pig—99%	32.25	....	32.125	32.125	32.125	32.00	32.00	31.90	32.00	32.00	32.00	31.875	31.875
Lead (f. o. b. St. L.) c/lb	5.60	....	5.60	5.65	5.65	5.65	5.65	5.65	5.70	5.70	5.80	5.85	5.95
Aluminum, c/lb.	18.00	....	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
	20.10	....	20.10	20.10	20.10	20.10	20.10	20.10	20.10	20.10	20.10	20.10	20.10
Nickel, c/lb.:													
Ingot—Internat. Nick. Co.	36	....	36	36	36	36	36	36	36	36	36	36	36
Outside Spot	34-35	....	34-35	34-35	32-34	32-34	32-34	32-34	32-34	32-34	32-34	32-34	32-34
Electrolytic (Internat. Nick. Co.)— Ni—99.80 contam. impurities—.14.	39	....	39	39	39	39	39	39	39	39	39	39	39
Brit.-American Nick. Corp.— Ni—98.50, contam. impurities—.80.	33	....	33	33	33	33	33	33	33	33	33	33	33
Antimony (Jap. and Chin.) c/lb.	5.375	....	5,375	5.625	5.75	6.00	6.25	6.25	6.25	6.50	6.75	6.75	7.00
Silver (foreign) c/oz.	69.625	....	70.75	70.00	70.125	69.875	69.75	69.875	69.50	68.875	68.875	69.25	69.625
Platinum $/oz.	108	....	108	118	118	118	118	118	118	118	118	118	118

Date	20	21	22	25	26	27	28	29	High	Low	Aver.	Oct. 6
Copper (f. o. b., Ref.) c/lb.:												
Lake (Delivered)	14.25	14.50	14.50	14.50	14.50	14.375	14.25	14.25	14.50	14.00	14.244	14.25
Electrolytic	13.875	13.875	13.875	13.875	13.875	13.875	14.00	14.00	14.00	13.875	13.888	14.00
Casting	13.40	13.40	13.40	13.40	13.40	13.40	13.40	13.40	13.40	13.375	13.39	13.40
Zinc (f. o. b. St. L.) c/lb.:												
Prime Western	6.75	6.80	6.85	6.85	6.90	6.90	6.85	6.85	6.90	6.25	6.575	6.65
Brass Special	6.85	6.90	6.95	6.95	7.00	7.00	6.95	6.95	7.00	6.35	6.675	6.80
Tin (f. o. b. N. Y.) c/lb.:												
Straits	32.30	32.60	32.625	32.65	32.50	32.40	32.55	32.75	32.70	32.125	32.411	32.90
Pig—99%	32 00	32.25	32.25	32.375	32.25	32.15	32.20	32.40	32.375	31.875	32.108	32.60
Lead (f. o. b. St. L.) c/lb	6.05	6.10	6.20	6.375	6.375	6.375	6.375	6.35	6.375	5.60	6.933	6.30
Aluminum, c/lb.	18.00	18.25	18.25	18.25	18.25	18.25	18.50	18.50	18.50	18.00	18.113	21
	20.10	20.10	20.10	20.10	20.10	20.10	20.10	20.10	20.10	20.10	20.10	....
Nickel, c/lb.:												
Ingot—Internat. Nick. Co.	36	36	36	36	36	36	36	36	36	36	36	36
Outside Spot	32-34	32-34	32-34	32-34	32-34	32-34	32-34	32-34	34-35	32-34	33.225	....
Electrolytic (Internat. Nick. Co.)— Ni—99.80 contam. impurities—.14.	39	39	39	39	39	39	39	39	39	39	39	39
Brit.-American Nick. Corp.— Ni—98.50, contam. impurities—.80.	33	33	33	33	33	33	33	33	33	33	33	33
Antimony (Jap. and Chin.) c/lb.	7.00	7.00	7.00	7.00	7.00	7.00	7.00	6.875	7.00	5.375	6.488	6.875
Silver (foreign) c/oz.	69.625	69.50	69.375	69.50	69.375	69.125	69.00	68.50	70.75	68.50	69.456	69.125
Platinum $/oz.	118	118	118	118	118	118	118	118	118	108	117	112

Metal Prices, October 6, 1922

INGOT METALS AND ALLOYS

Brass Ingot, Yellow	" " "	10 to12¼
Brass Ingots, Red	" " "	12¾to14
Bronze Ingot	" " "	13 to15¼
Bismuth		2.45
Cadmium		1.15-1.25
Casting Aluminum Alloys	" " "	18 to21
Chromium Metal—95-98% Cr., per lb. Cr. contained		1.50
Cobalt—97% pure		3.00-3.25
Manganese Bronze Castings	" " "	21 to33
Manganese Bronze Ingots	" " "	12 to15½
Manganese Bronze Forgings	" " "	30 to40
Manganese Copper, 30%	" " "	28 to45
Manganese Metal—95-98% Mn., carbon free, per lb.		0.75
Magnesium Metal—Duty 20% ad valorem		$1.25-1.35
Monel Metal	" " "	38
Parsons Manganese Bronze Ingots	" " "	16½to18
Phosphor Bronze	" " "	24 to30
Phosphor Copper, guaranteed 15%	" " "	17 to23
Phosphor Copper, guaranteed 10%	" " "	16½to22
Phosphor Tin, guarantee 5%	" " "	40 to50
Phosphor Tin, no guarantee	" " "	35⅝to45⅝
Quicksilver—Duty 10% per flask of 75 lbs.		$55-$56
Silicon Copper, 10%	according to quantity	28 to35

OLD METALS

Buying Prices		Selling Prices
11¼to11¾	Heavy Cut Copper	12½to12¾
11 to11½	Copper Wire	12¼to12½
10 to10¼	Light Copper	11 to11¼
8½to 9	Heavy Machine Comp	10 to10½
6¾to 7	Heavy Brass	8 to 8½
5½to 6	Light Brass	7 to 7¼
6¼to 6½	No. 1 Yellow Brass Turnings	7¼to 7½
7¾to 8½	No. 1 Comp. Turnings	9¼to10
4½to 4¾	Heavy Lead	5 to 5¼
4½	Zinc Scrap	4¾to 5
7 to 7½	Scrap Aluminum, Turnings	9 to10
12 to13	Scrap Aluminum, cast alloyed	14½to15½
15 to16	Scrap Aluminum, sheet (new)	17½to18½
18½	No. 1 Pewter	22½
15	Old Nickel anodes	17
23 to25	Old Nickel	27 to29

BRASS MATERIAL—MILL SHIPMENTS

In effect September 27, 1922

To customers who buy 5,000 lbs. or more in one order.

	Net base per lb. High Brass	Low Brass	Bronze
Sheet	$0.18½	$0.20	$0.21½
Wire	0.19	0.20½	0.22
Rod	0.17	0.21	0.22½
Brazed tubing	0.25⅜	.....	0.30¼
Open seam tubing	0.25⅜	.....	0.30¼
Angles and channels	0.28⅜	.....	0.33¼

To customers who buy less than 5,000 lbs. in one order

	Net base per lb. High Brass	Low Brass	Bronze
Sheet	$0.19½	$0.21	$0.22½
Wire	0.20	0.21½	0.23
Rod	0.18	0.22	0.23½
Brazed tubing	0.26⅜	.....	0.31¼
Open seam tubing	0.26⅜	.....	0.34¼
Angles and channels	0.29⅜	.....	0.34¼

SEAMLESS TUBING

Brass, 23c. to 24c. per lb. base.
Copper, 24¾c. to 25¾c. per lb. base.

TOBIN BRONZE AND MUNTZ METAL

Tobin, Bronze Rod	20½c. net base
Muntz or Yellow Metal Sheathing (14"x48")	18½c. " "
Muntz or Yellow Rectangular Sheets other than Sheathing	19½c. net base
Muntz or Yellow Metal Rod	16½c " "

Above are for 100 lbs. or more in one order.

COPPER SHEET

Mill shipments (hot rolled)	21½c.-22½c. net base
From stock	22½c.-23½c. net base

BARE COPPER WIRE—CARLOAD LOTS

16c. to 16¼c. per lb. base.

SOLDERING COPPERS

300 lbs. and over in one order	19¾c. per lb. base
100 lbs. to 200 lbs. in one order	20¼c. per lb. base

ZINC SHEET

Duty, sheet, 15%. Cents per lb.

Carload lots, standard sizes and gauges, at mill, 8¼c. basis less 8 per cent. discount.

Casks, jobbers' prices	9c. to 9½c.
Open casks, jobbers' prices	9¼c. to10¼c.

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga. and heavier, base price	32c.
Aluminum coils, 24 ga. and heavier, base price	30c.

NICKEL SILVER (NICKELENE)

Base Prices

Grade "A" Nickel Silver Sheet Metal

10% Quality	26¾c. per lb.
15% "	28½c. " "
18% "	29¼c. " "

Nickel Silver Wire and Rod

10% "	29¾c. " "
15% "	33¾c. " "
18% "	36½c. " "

MONEL METAL

Shot	32
Blocks	32
Sheet Bars	40
Hot Rolled Rods (base)	40
Cold Drawn Rods (base)	50
Hot Rolled Sheets (base)	45

BLOCK TIN SHEET AND BRITANNIA METAL

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more, 10c. over Pig Tin. 40 to 100 lbs., 15c. over 25 to 50 lbs., 17c. over, less than 35 lbs., 25c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. or more, 10c. over Pig Tin. 50 to 100 lbs., 15c. over, 25 to 50 lbs., 20c. over, less than 25 lbs., 25c. over. Above prices f. o. b. mill.

SILVER SHEET

Rolled silver anodes .999 fine are quoted at from 73c. to 75c. per Troy ounce, depending upon quantity.

Rolled sterling silver 70c. to 72c.

NICKEL ANODES

85 to 87% purity	42½c. per lb.
90 to 92% purity	45c. per lb.
95 to 97% purity	47½c. per lb.

Supply Prices, October 6, 1922

CHEMICALS

In Commercial Quantities—New York Prices

Acetone	lb.	.16½-.18
Acid—		
Boric (Boracic) Crystals	lb.	.14
Hydrochloric (Muriatic) Tech., 20 deg., Carboys	lb.	.02½
Hydrochloric, C. P., 20 deg., Carboys	lb.	.08
Hydrofluoric, 30%, bbls.	lb.	.07
Nitric, 36 deg. Carboys	lb.	.07
Nitric, 42 deg. Carboys	lb.	.07¼
Sulphuric, 66 deg. Carboys	lb.	.02½
Alcohol—		
Butyl	lb	.18-23
Denatured in bbls.	gal.	.36
Alum—		
Lump, Barrels	lb.	.04½
Powdered, Barrels	lb.	.05½
Aluminum sulphate, commercial tech	lb.	.02½-.03
Aluminum chloride solution	lb.	.20
Ammonium—		
Sulphate, tech., Barrels	lb.	.04
Sulphocyanide	lb.	.50
Argols, white, see Cream of Tartar	lb.	.27
Arsenic, white, Kegs	lb.	.10
Asphaltum	lb.	.35
Benzol, pure	gal.	.60
Blue Vitriol, see Copper Sulphate.		
Borax Crystals (Sodium Biborate), Barrels	lb.	.06½
Calcium Carbonate (Precipitated Chalk)	lb.	.05
Carbon Bisulphide, Drums	lb.	.09
Chrome Green	lb.	.36
Cobalt Chloride	lb.	—
Copper—		
Acetate	lb.	.36
Carbonate, Barrels	lb.	.20
Cyanide	lb.	.58
Sulphate, Barrels	lb.	.06½
Copperas (Iron Sulphate, bbl.)	lb.	.02½
Corrosive Sublimate, see Mercury Bichloride.		
Cream of Tartar, Crystals (Potassium bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluor-spar (Calcic fluoride)	ton	$75.00
Fusel Oil	gal.	3.00
Gold Chloride	oz.	14.00
Gum—		
Sandarac	lb.	.30
Shellac	lb.	—
Iron, Sulphate, see Copperas, bbl	lb.	.02½
Lead Acetate (Sugar of Lead)	lb.	.12-.13
Yellow Oxide (Litharge)	lb.	.09
Mercury Bichloride (Corrosive Sublimate)	lb.	1.10
Nickel—		
Carbonate Dry	lb.	.40
Chloride, 100 lb. lots	lb.	.27½-.40
Salts, single, bbls	lb.	.12
Salts, double, bbl	lb.	.11
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity		.25-.30
Potash, Caustic, Electrolytic 88-92% fused, drums	lb.	.06½
Potassium Bichromate, casks	lb.	.11
Carbonate, 80-85%, casks	lb.	.05
Cyanide, 165 lb. cases, 94-96%	lb.	.60
Pumice, ground, bbls	lb.	.02½
Quartz, powdered	ton	$30.00
Official	oz.	—
Rosin, bbls.	lb.	.03½
Rouge, nickel, 100 lb. lots	lb.	.20
Silver and Gold	lb.	.60
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.08
Silver Chloride, dry	oz.	.86
Cyanide	oz.	—
Nitrate, 100 ounce lots	oz.	.47
Soda Ash, 58%, bbls	lb.	.03
Sodium—		
Biborate, see Borax (Powdered), bbls	lb.	.05½
Bisulphate, tech., bbls	lb.	.03½
Cyanide, 96 to 98%, 100 lbs	lb.	.25
Hydrate (Caustic Soda) bbls	lb.	.04½
Hyposulphite, kegs	lb.	.04
Nitrate, tech. bbls	lb.	.04
Phosphate, tech., bbls	lb.	.03¾
Silicate (Water Glass) bbls	lb.	.02½
Sulpho Cyanide	lb.	.45
Soot, Calcined	lb.	—
Sugar of Lead, see Lead Acetate	lb.	.12-.13
Sulphur (Brimstone) bbls	lb.	.01¾
Tin Chloride, 100 lb. kegs	lb.	.30
Tripoli	lb.	.03
Verdigris, see Copper Acetate	lb.	.36
Water Glass, see Sodium Silicate, bbls	lb.	.02½
Wax—		
Bees, white ref. bleached	lb.	.55
Yellow, No. 1	lb.	.30
Whiting, Bolted	lb.	.02½-.06
Zinc, Carbonate, bbls.	lb.	.13-.17
Chloride, 600 lb. lots	lb.	.06½
Cyanide	lb.	.41-.42
Sulphate, bbls.	lb.	.03½

COTTON BUFFS

Open buffs, per 100 sections (nominal).

12 inch, 20 ply, 64/68, cloth	base,	36.60
14 inch, 20 ply, 64/68, cloth	base,	45.55
12 inch, 20 ply, 84/92, cloth	base,	42.55
14 inch, 20 ply, 84/92, cloth	base,	57.35
12 inch, 20 ply, 88/96, cloth	base,	46.20
14 inch, 20 ply, 88/96, cloth	base,	62.25
Sewed Buffs, per lb., bleached and unbleached	base,	.50

FELT WHEELS

		Price Per Lb. Less Than 100 Lbs.	300 Lbs. and Over
Diameter—10" to 16"	1" to 3"	2.60	2.35
" 6" 8" and over 16"	1" to 3"	2.70	2.45
" 6" to 24"	Over 3"	3.00	2.75
" 6" to 24"	½" to 1"	3.60	3.35
" 4" to 6"	¼" to 3"	4.60	Any quantity
" Under 4"	¼" to 3"	5.20	Any quantity

Grey Mexican or French Grey—10c. less per lb. than Spanish, above. Odd sizes, 50c. advance.